



COLONY AND PROTECTORATE OF KENYA

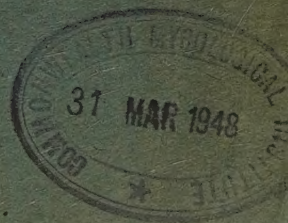
DEPARTMENT
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ANNUAL REPORT
1946

PARTS I, II AND III

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DEPARTMENT OF AGRICULTURE

ANNUAL REPORT, 1946

PART I—AGRICULTURE IN 1946

WEATHER

The short rains of 1945, although not much below average, were largely confined to November and were followed throughout the Colony by hot, dry weather until April. Hence, by the end of the hot season, the country as a whole was in an exceptionally dry condition. Whereas in the western half of the Colony the long rains were above average and were in many parts prolonged into an excessively wet June, July and August, in the eastern half the long rains were themselves below average.

The short rains throughout the Colony were, on the other hand, well above average and the crop prospects by the end of the year were accordingly very favourable.

(For the following detailed notes on weather conditions, together with Tables A and B, the Director of Agriculture is indebted to the Director of the British East African Meteorological Service.)

Trans Nzoia.—The total rainfall for the year was 15 per cent above average. Falls in the dry season were lighter than usual, but most other months were wetter than normal, the most marked excesses being 85 per cent in June and 79 per cent in August.

Kavirondo.—The total rainfall for the year was 10 per cent above average. Although dry conditions existed during the first two months of the year, the only other months with deficits were March and October. August showed an excess of 74 per cent.

West Rift.—The total rainfall for the year was 1 per cent below average. Conditions were not unlike those in the Rift area, except that an excess of 66 per cent in June brought the annual total up to nearly normal.

Rift.—The total rainfall for the year was 9 per cent below average. The rains were again late in starting and this, combined with drier than normal conditions in November and December, slightly outweighed excesses in August and September of 41 per cent and 50 per cent respectively.

East Rift.—The total rainfall for the year was 18 per cent below average. The rains were late in starting and monthly falls were below average for nine months of the year, the most marked deficit being 73 per cent in March. August to October were wetter than normal, September showing an excess of 82 per cent.

Main Coffee Areas.—The total rainfall for the year was 7 per cent below average. The drier than normal conditions experienced in several previous years persisted until July, but the period August to October was much wetter than usual and falls in September were four times the average value.

Coast.—The total rainfall for the year was 3 per cent above average. Except in August and September, falls were below average and particularly so in April. September was very wet, falls exceeding six times the average value.

TABLE A
RAINFALL OVER THE MAIN AGRICULTURAL AREAS OF KENYA—1946

DISTRICT Number of Stations	Trans Nzoia 16		Kavirondo 19		West Rift 11		Rift 22		East Rift 18		Main Coffee Areas 29		Coast 17	
	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall	Mean Fall 1946	Ave. Fall
	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>	<i>In.</i>
January ..	0.14	0.76	0.78	2.07	0.20	1.42	0.21	0.97	0.35	1.21	0.09	1.47	0.12	1.00
February ..	0.29	1.69	0.20	3.67	0.10	2.52	0.06	1.55	0.31	1.40	0.17	1.90	0.36	0.59
March ..	1.77	2.98	4.08	5.66	1.51	4.20	0.88	3.25	0.67	2.47	1.77	4.70	0.21	2.28
April ..	6.93	5.56	10.26	8.66	8.47	6.50	5.92	5.45	4.14	5.23	7.47	8.94	3.11	6.54
May ..	5.79	6.26	10.09	9.46	5.66	6.25	4.21	5.22	3.64	4.35	5.53	5.32	12.64	11.97
June ..	8.41	4.54	7.38	5.48	8.20	4.95	4.42	3.37	2.06	2.11	0.40	1.58	3.33	5.44
July ..	6.59	6.02	5.80	4.70	4.53	5.88	3.40	4.51	1.88	3.24	0.41	0.65	2.43	3.02
August ..	11.20	6.26	10.46	6.02	9.07	6.45	6.36	4.50	3.79	3.15	1.70	0.82	3.91	2.30
September ..	3.91	3.77	6.52	5.56	4.82	3.81	3.88	2.59	2.68	1.47	3.83	0.94	13.49	2.03
October ..	3.04	2.59	4.13	4.30	3.44	2.47	2.70	2.34	3.84	2.39	6.59	2.64	2.71	3.05
November ..	1.68	2.62	6.52	4.95	1.75	3.04	1.99	2.91	2.13	3.54	4.45	5.91	1.62	2.96
December ..	0.73	1.01	3.91	3.05	1.32	1.97	0.88	1.70	1.08	1.99	3.11	3.19	1.32	2.69
YEAR ..	50.48	44.06	70.13	63.58	49.07	49.46	34.91	38.36	26.57	32.55	35.52	38.06	45.25	43.87

TABLE B
PERCENTAGE DEPARTURES

	Trans Nzoia	Kavirondo	West Rift	Rift	East Rift	Main Coffee Areas	Coast
January ..	-81	-62	-86	-78	-71	-94	-88
February ..	-83	-95	-96	-96	-78	-91	-39
March ..	-41	-28	-64	-13	-73	-62	-91
April ..	+25	+18	+30	+9	-21	-16	-52
May ..	-7	+7	-9	-19	-16	+4	+6
June ..	+85	+35	+66	+31	-2	-75	-39
July ..	+9	+23	-23	-25	-42	-37	-20
August ..	+79	+74	+41	+41	+20	+107	+70
September ..	+4	+17	+27	+50	+82	+307	+565
October ..	+18	-4	+39	+15	+61	+150	-11
November ..	-36	+32	-42	-32	-40	-25	-45
December ..	-28	+28	-33	-48	-46	-3	-51
YEAR ..	+15	+10	-1	-9	-18	-7	+3

AGRICULTURAL EXPORTS IN 1946

The total value of agricultural produce exported from Kenya in 1946 amounted to £5,622,128, an increase of 19 per cent over the figure of £4,720,215 for 1945.

The quantities of bacon and ham, butter, and beans and pulses continued to increase, 50 per cent, 60 per cent and 130 per cent respectively, while the export of skins, pyrethrum and wattle bark and extract showed recoveries from the setback of last year with increases of 100 per cent, 40 per cent and 30 per cent respectively. Major decreases in exports were in cotton (60 per cent), maize and maize meal (60 per cent), ghee (50 per cent) and wheat and wheat meal (30 per cent).

Table C shows the quantities and values of major items of agricultural produce exported during the last four years together with corresponding figures for 1939 which provide interesting comparisons. In 1939 the major items of produce exported were, in order of value, coffee, tea, sisal, pyrethrum, maize and maize meal, wattle bark and extract, cotton and wheat and wheat meal. The first four crops are still the most valuable, but pyrethrum has for the last three years taken first place and tea has dropped to fourth, while wattle bark and extract and wheat have moved up to fifth and sixth.

Other interesting comparisons are to be seen in the increased export values of certain commodities. Values as a whole have increased during the last eight years, but the biggest increase is in the case of beans, the 1946 value being five times that of 1939. Increases of between two and three times have taken place in the export values of hides, skins, coffee, sisal, maize, wheat and potatoes, while tea and pyrethrum show only slight increases.

CROPS

Barley.—There was a slight reduction in the acreage and yield under barley, 52,525 bags (of 180 lb.) being produced in 1945–46 from 10,235 acres, compared with 54,269 bags from 12,171 acres in 1944–45. The prolonged heavy rain in Trans Nzoia reduced yields, but in Laikipia excellent crops were obtained. Rather more than half the crop was retained on farms for feeding purposes.

Cashew Nuts.—This crop is now one of considerable and increasing importance on the coast; 1945–46 production amounted to 752 tons, the largest ever recorded. The price to the grower was raised from 8 cents to 12 cents per pound and the cash return to the grower was £10,104. Production in 1946–47 is unfortunately being hampered by the general shortage of tin plate.

Cassava.—Production of dried cassava in Nyanza Province increased sharply from 4,397 bags valued at £1,099 in 1945 to 37,404 bags valued at £9,351 in 1946. The fact that there is a market for cassava at 4 cents per pound is facilitating the extension of this valuable famine reserve crop.

Coffee.—The 1945–46 crop showed a further slight recovery from the exceptionally low production of 1943–44 and amounted to 6,952 tons valued at £698,160, compared with 6,200 tons valued at £669,600 in 1944–45. The average payout to producers by the Coffee Control was Sh. 101/64 per cwt., compared with Sh. 93/77 per cwt. in 1944–45.

Crops suffered considerably from drought during the year and the lower areas lost much of their crop as a result of a heavy infestation of thrips. The percentage of bold coffee was well below average. Although, so far as is known, no crop was actually lost through lack of labour, the shortage of labour materially affected the condition in which it was possible to maintain estates. This was

particularly noticeable during the picking season, when often the whole labour force had to be concentrated on picking to the detriment of normal maintenance, which thereby became very much in arrears.

With the partial failure of the long rains east of the Rift, the 1946-47 crop started under unfavourable conditions and again there was heavy incidence of thrips. With rainfall above average in the latter half of the year recovery was rapid and the 1946-47 crop is expected to produce 9,000 tons, which will be a substantial increase over the last few years.

Interest in African-grown coffee is being maintained and production is slowly but steadily increasing. Good yields were obtained in both the Kisii and the Embu-Meru areas, although the former suffered from antestia. The total gross return to African growers during 1946 was £4,800.

Copra.—Copra production showed a sharp recovery from the setback of 1945; the price increase from Sh. 6/50 to Sh. 9/25 per frasila of 36 lb. for local and from Sh. 6/75 to Sh. 9/50 for plantation, coupled with a good season and a falling off in the demand for green nuts in Mombasa, was responsible for a production of 1,783 tons in 1946, compared with 250 tons in 1945 and 1,000 tons in 1944.

Cotton.—The cotton industry remained depressed, owing to the need for concentrating on the production of cereals and oil seeds. A rather larger acreage was sown in Nyanza in 1945 than in 1944, and the variety N.17 was discarded in favour of B.P.52. Early growth was very satisfactory, but later in the season boll shedding was severe and the total 1945-1946 yield of 4,320 bales of 400 lb. was only ten bales greater than in the previous season. The price to the grower was 17 cents per pound first grade seed cotton. On the coast the 1945-46 crop amounted to only 695 bales (1944-45: 1,095 bales), the price to the grower being 18 cents per pound.

As a result of the poor 1945-46 crop, there was considerable reluctance to open up new land in Nyanza, but with a favourable season a slightly increased yield is expected. The 1946-47 season on the coast promises to be one of the best on record.

Essential Oils.—The essential oil industry has recovered from the setback of the war years and exports in 1946 amounted to 5,698 gallons, valued at £21,332, which is the highest annual value of exports ever recorded.

Flax.—The very disappointing 1944 crop led to a further sharp decrease in acreage under flax in the 1945-46 season. Early weather conditions were not very favourable, hail causing much damage, but harvest conditions were excellent and for the acreage sown the best crop for some years was obtained with a yield of 4.25 cwt. of flax and tow per acre, and a proportion of fibre to tow of 1 to 1.11. Production was 352.37 tons of fibre and 391.85 tons of tow from 3,500 acres, corresponding prices being £181 and £80 per ton f.o.b. Mombasa.

The Ministry of Supply withdrew its guaranteed price for flax in 1946 and the crop was also withdrawn from the Guaranteed Minimum Return Scheme under the Increased Production of Crops Ordinance. As a result, only 450 acres were sown during 1946, mainly in the higher areas.

Groundnuts.—Weather conditions were favourable in Nyanza and a good crop was harvested; most of it was sold locally and Produce Control purchased only 14,255 bags (180 lb.) which, however, was double the quantity bought in 1945.

Kapok.—In spite of the steady demand and comparatively good price (20 cents per lb.), kapok, which grows well at the coast, is not a popular crop and production in 1945–46 was only 5,561 lb. The price was increased for the 1946–47 season and a greater production is expected.

Maize.—The 1945 non-native crop yielded 820,714 bags from 124,855 acres, together with 98,578 bags of squatter maize. Of this total of 919,292 bags, 590,921 bags were delivered to the Control, the remainder being retained on the farm. The yield per acre fell to an average of 6.6 bags compared with 7 bags in the previous season. Very few localities showed an average yield of 8 or more bags to the acre.

Deliveries to the Control during 1946 were as follows:—

Non-native	.. ..	562,243 bags	(1945: 545,515 bags)
Native (Nyanza)	.. ..	666,308 bags	(1945: 716,459 bags)
Native (other)	.. ..	108,990 bags	(1945: 16,151 bags)

The price to the non-native farmer for the higher grades was Sh. 13 per bag f.o.r. sender's station, with a grant of Sh. 7/50 per acre for acreage authorized to be planted and a bonus payment for delivery in excess of a target-figure of 400,000 bags of Sh. 7 per bag. Native growers received the equivalent of Sh. 13 per bag with provision for a bonus payment of Sh. 7 per bag for deliveries in excess of 800,000 bags; this bonus was not to be paid to individual producers but into a fund for the benefit of the native areas concerned, but the target figure was not reached.

Exports during 1946, other than to Tanganyika and Uganda, which are participants in the Cereals Pool, amounted to 47,587 bags of maize and mixed meal; 454,953 bags of mixed meal were delivered for famine relief, 65,867 bags to the Military and 1,023,012 bags for normal civil consumption within the Colony.

As the main non-native maize producing areas are in the Rift or to the north-west where the long rains were satisfactory, the 1946 crop promised to be better than that of the previous year. The prolonged rains in July and August, however, adversely affected the crop in Trans Nzoia, particularly in the higher areas, through waterlogging of the soil causing chlorosis and exceptional weed growth which was inadequately controlled because of labour difficulties. In Nyanza, weather conditions were favourable and increased production was evident in Central and South Kavirondo. In North Kavirondo, on the other hand, soil exhaustion has so increased that larger acreages have not produced any corresponding increase in yield. Considerable loss of crop was due to pink ear rot, which was more noticeable in Nyanza than in Trans Nzoia.

Oats.—There was a sharp reduction in the area sown to oats in 1945–46, but the average yield per acre remained about the same, good crops in Laikipia counterbalancing low yields in Trans Nzoia due to leaf rust and loose smut. The total production was 28,534 bags (150 lb.) from 5,148 acres, compared with 44,246 bags from 8,085 acres in 1944–45.

Other Cereals.—Excellent sorghum (*m'tama*) crops were obtained throughout Nyanza; 27,871 bags (200 lb.) were delivered to Control compared with 8,613 bags in 1945. Conditions were also satisfactory for finger millet (*wimbe*); the quantity sold to Control was 45,668 bags (200 lb.), mainly from South Kavirondo (1945: 23,164 bags). Control also bought 8,525 bags (200 lb.) of bullrush millet from Central Province (1945: 7,431 bags).

Passion Fruit.—During the year ending the 31st July, 1946, 6,907 gallons of passion fruit juice were produced, of which 5,973 gallons were exported and 934 gallons were sold locally. The total production shows a drop of 2,599 gallons from the figure for the previous season. This reduction was in the main due to the poor short rains of 1945 and the long dry period early in 1946. With the improvement in weather conditions later in the year, the 1946–47 production is expected to show a marked recovery. The area under passion fruit is 241 acres, of which 136 acres are not yet in bearing.

The gross return to producers amounted to 8.4 cents per gallon compared with 5.4 cents during 1944–45, but of this 1.2 cents per gallon has temporarily been paid into an Equalization Fund.

Potatoes.—Deliveries to the Control were:—

Non-native	.. .. .	1,976 tons	(1945: 5,647 tons)
Native	.. .. .	21,142 tons	(1945: 21,744 tons)
Total ..		23,118 tons	

More than a third of this production was supplied to H.M. Forces, 5,432 tons as fresh potatoes and 3,819 tons, for dehydration, to the Dried Vegetable Factories at Karatina and Kerugoya. The internal supply position was satisfactory except for the usual period of shortage in the second quarter of the year and after supplying local needs 8,246 tons were available for export (1945: 5,500 tons).

Pulses.—Many types of pulses are widely grown as food crops by natives, but Meru and Embu remain the main producing areas of pulses for sale. Sales from Central Province amounted to 38,665 bags valued at £108,182, compared with 39,663 bags valued at £84,014 in 1945; a combined total of some 9,000 bags were marketed in Nyanza and Coast Provinces.

Pyrethrum.—This crop continues to be the most valuable individual export crop of Kenya, exports during 1946 amounting to 7,443 tons, valued at £1,156,402. Deliveries of dried flowers to the Agency appointed under the Pyrethrum Ordinance amounted to 6,860 tons from 52,631 acres, compared with 7,409 tons from 52,837 acres in 1945. The Ministry of Supply's contract price of Sh. 1/25 per pound to the farmers for Grade I flowers remained unaltered throughout the year. Sales of flowers during 1946 was rather more difficult than usual owing to the disputes in the U.S.A. over pyrethrin content, due to the absence of an agreed standard method of analysis. Claims made by American buyers were still awaiting settlement by the Board of Trade at the end of the year.

A new disease of pyrethrum caused by *Ramularia bellunensis* Speg, appeared during June. While the outbreak was most severe in the Molo area, where it caused considerable loss, by the end of the year the disease was reported from most producing areas. The disease is described by the Senior Plant Pathologist in Part III of this report.

Rice.—The main area of production as a cash crop is in North Kavirondo, where the delay in the long rains followed by excessive rain later reduced both acreage and yield per acre. Produce Control purchased 14,289 bags of paddy in Nyanza, including 3,715 bags from the lake shore areas of Central Kavirondo. Conditions were also unsatisfactory on the coast, where nearly the whole crop is consumed locally. Promising crops grown under irrigation at Taveta suffered enormous losses through grain-eating birds.

Rubber.—With the reduction of the Ministry of Supply's guaranteed price to a figure at which local production, with its falling yields and rising costs, was no longer economically possible, both wild rubber collection and plantation rubber production, which had been stimulated solely to meet war-time needs, abruptly ceased.

Rye.—Owing to its susceptibility to stem rust, rye has now been virtually abandoned. The area sown in 1945-46 was 2,221 acres, which yielded only 988 bags, an average yield of 0.4 bags per acre. These figures compare with 24,862 bags from 13,057 acres in 1944-45.

Sesame.—North Kavirondo was the only Nyanza district to show much interest in this crop, most of which was consumed internally, only 1,577 bags (180 lb.) being bought by Produce Control. A fair crop on the coast was also consumed locally.

Sisal.—During 1946 the whole of the production of sisal continued to be under the control of the United Kingdom Ministry of Supply. The total area under sisal was 207,438 acres, of which 41,103 acres were immature. This acreage yielded a total of 27,038 tons of fibre and tow compared with a production of 31,682 tons from 193,539 acres in 1945. Part at least of this reduction was due to labour difficulties, which not only hampered cutting operations but also prevented proper maintenance; as these show no signs of amelioration and the shortfall in rotational planting is not being made up, it is feared that the 1947 production will be even less.

Sisal exports during the year amounted to 24,555 tons of fibre and tow, valued at £858,830. A total of 744 tons of fibre and tow, mainly of unexportable grades, was sold to Sisal Products (E.A.), Ltd., for the manufacture of ropes, bags and twines for local use.

Sugar.—During the twelve months ending on the 30th November, 1946, the five factories established in the Colony produced 5,760 tons of sugar and 870 tons of jaggery. This production compares unfavourably with the 8,187 tons produced in 1945 and the drop is due partly to the dry weather conditions of recent years, which did not improve until the latter part of 1946; the prevalent labour shortage also seriously affected output. The acreage for 1947 cutting is estimated at 11,180, compared with 10,100 acres in the previous year.

Tea.—The gardens in the main producing area, Kericho, suffered from the prolonged hot, dry season early in the year and again later from the exceptionally heavy rains of August onwards. Considerable hail damage was also experienced. In common with other plantation industries, the shortage of labour led to difficulties in picking and in garden maintenance. The combination of these unfavourable factors led to the lowest annual production since 1941, the crop amounting to only 12,277,000 lb., compared with 13,023,000 lb. in 1945 and 13,789,000 lb. in 1944 (not 31,789,000 lb. as printed in the 1945 report). Of the total of 16,239 acres under tea, 1,513 acres are as yet unproductive. In Kericho 12,755 productive acres produced 11,399,000 lb. of tea.

Arrangements governing the disposal of the crop remained unchanged during 1946. After providing for internal supplies and local export territories, the exportable surplus of 3,986,000 lb. was sold to the Ministry of Food under contract with individual estates. The weighted average contract price was 14.31d. per pound f.o.b. Mombasa. As Tea Commissioner for Kenya, Tanganyika and Uganda, the Director of Agriculture continued to operate as agent for the Ministry of Food.

Tobacco.—Tobacco production in Central Province for flue curing in 1945–46 amounted to 1,075,454 lb. of green leaf from 403 acres. The short rains 1945 crop in Fort Hall and Embu was one of the worst ever experienced, the leaf being small and difficult to cure.

Vegetables.—Production of dried vegetables from the two factories at Karatina and Kerugoya amounted to 1,059 tons, only half the production of the previous year. Two-thirds of this production was dried potatoes. The factories were unable to complete a 1,000 ton contract starting on the 1st April, 1946, owing mainly to the diversion of supplies of potatoes to famine areas and to Tanganyika Territory. The factories closed down in December.

Since the inception of the project, 6,614 tons of dried products valued at £1,221,769 have been produced, and the gross return to growers and employees amounted to £384,812.

Apart from sales to the Dried Vegetable Factories, the demand for fresh vegetables from Central Province was maintained, a falling off in military requirements being balanced by increased civilian consumption. In the Teita hills, where much attention has been given to stimulating vegetable production to meet Mombasa's requirements, production fell owing to drought, diminishing demand from Mombasa and the need to produce more cereals for local consumption. Sales fell from 1,988,052 lb. in 1945 to 1,090,084 lb. in 1946, valued at £5,450 to the producer.

Wattle.—Bark production in Central Province, the main producing area, increased from 441,000 cwt. in 1945 to 574,020 cwt. in 1946; production would have been greater but for prolonged misty weather in the higher areas which delayed drying and caused deterioration and for a shortage of rolling stock on the railway. Exports from the Colony amounted to 157,030 cwt. of bark and 238,923 cwt. of extract valued together at £331,485, compared with 184,859 cwt. of bark and 171,163 cwt. of extract valued at £254,551 in 1945.

Wheat.—The 1945–46 non-native crop produced 841,036 bags (200 lb.) from 177,943 acres, an average yield of 4.7 bags per acre. This average yield, though not so high as in 1943–44, is considerably higher than in 1944–45, when 593,286 bags were produced from 160,171 acres. The price received by the farmer for Grade I wheat was fixed at Sh. 27/50 per bag f.o.r. sender's station.

The heavy rains of July and August, 1946, and the consequent waterlogging of the soil had an even more depressing effect on the yields of wheat in the Plateau and Trans Nzoia areas than of maize. Other factors leading to a disappointing crop were insufficient supplies of superphosphate and the incidence of leaf rust and glume blotch. The season was more satisfactory in the other main areas, particularly in Laikipia, where in the higher areas there is a swing away from the variety 117A in favour of Equator, which is not so susceptible to lodging. A waning of interest in wheat is reported from Meru owing to the greater return per acre from other cereals, but interest is growing in some other parts of Central Province.

LIVE STOCK PRODUCE

Bacon and Lard.—Deliveries of pigs by the Supply Board (Pig Control) to bacon factories during the year consisted of 25,851 baconers and 4,549 larders. Rather more than one quarter of the bacon production was delivered to H.M. Forces. Exports of bacon and ham during the year amounted to 4,654 cwt. valued at £40,058, compared with 2,954 cwt. valued at £25,852 in 1945.

Butter.—Butter production at the five creameries of Kenya Co-operative Creameries, Ltd., in the year ending the 30th June, 1946, showed a further increase to 5,724,613 lb. compared with 5,116,054 in the previous year. Only at the Thomson's Falls Creamery was a substantial increase not recorded. The pay-out for first grade butterfat remained at Sh. 1/50 per pound. Internal consumption of butter was slightly reduced owing to falling military demands, while the amount exported, 1,753,491 lb. was double that of the previous year; nearly half of this export was to Rhodesia.

Cheese.—Cheese production by Kenya Co-operative Creameries, Ltd., amounted to 357,683 lb. and sales to 354,190 lb.

Eggs.—The marketing of eggs in Central and Nyanza Provinces continued to be controlled, but sales dropped somewhat during 1946 from the very high figure of 1945. Figures of native eggs marketed during 1946 are as follows:—

	Number	Value to Producer
Central Province	7,231,794	£35,493
Nyanza Province	5,060,952	£19,231
Total	12,292,746	£54,724

Corresponding figures for 1945 were a total of 15,008,418 eggs valued at £78,000.

Hides and Skins.—Exports were as follows:—

	1945	1946
	Cwt.	Cwt.
Hides (shade dried)	26,958	25,640
Hides (sun dried)	8,037	8,515
	No.	No.
Skins (shade dried)	355,777	864,966
Skins (sun dried)	499,977	810,539

The total value was £378,852, compared with £196,841 in 1945. Apart from the doubling of the number of skins, mainly goat skins, exported, the value of shade dried hides rose from Sh. 85 to Sh. 123 per cwt.

Poultry.—There was a slight reduction in poultry sales in Central Province during 1946, 209,121 head valued at £22,385 passing through inspection centres compared with 215,059 head valued at £25,729 in 1945.

Slaughter Stock.—The Meat Marketing Board bought the following quantities of live stock for slaughter during 1946 (the corresponding figures for 1945 are shown in brackets):—

	Non-native	Native
Cattle (including calves)	24,525 (21,934)	64,260 (72,275)
Sheep and lambs	31,751 (27,045)	—
Sheep and goats	—	110,163 (143,583)

14,518 pigs were also bought, compared with 17,002 in 1945.

Wool.—Flocks did well during the year and wool clips have been good. Exports during 1946 amounted to 6,690 centals (of 100 lb.) valued at £30,156, compared with 22 centals valued at £168 in 1945 and 8,315 centals valued at £33,425 in 1944.

PRODUCTION IN NATIVE AREAS

Production in the three main native provinces, Nyanza, Central and Coast, was maintained at a high level during the year and but for the lateness and partial failure of the long rains in the eastern half of the Colony food supplies would everywhere have been adequate. As it was, no part of Nyanza Province was short of food, but in Central Province considerable famine relief was again necessary in Machakos and Kitui and to a small extent in Tharaka, while in the Coast Province there were periods of food shortage, particularly in the inland locations. The very good short rains relieved anxiety everywhere and by the end of the year the food situation was satisfactory.

Table D gives figures for the three provinces of the surplus production of certain of the more important crops and animal products. It will be understood that the figures given in no way represent total production, because in the case of food crops and oil seeds a large amount of the total crop produced is consumed by the grower or exchanged in food markets, while in the case of certain marketable products, such as vegetables, no record is available of the quantities sold in townships close to the source of supply.

Particulars of production and comparisons with 1945 are given in greater detail in the Annual Reports of the Senior Agricultural Officers in Part III.

LOCUSTS

The migratory phase of the desert locust *Schistocerca gregaria* continued to invade and breed in the Colony during the year, and it was still necessary to organize full-scale locust destruction campaigns against it. These differed from the campaigns of the previous year in that they were run for the first time on an entirely civilian basis.

Escapes after the ninth campaign, which ended in February, 1946, were heavy and the majority made their way southwestwards into Northern Tanganyika, whence a good many returned northwards into Kenya during April and May, prior to the long rains, and these gave rise to the *Tenth Hopper Destruction Campaign*. The heaviest breeding during this campaign occurred in Masai, although some swarms found their way into the Northern Frontier District and subsequently laid in Isiolo, Marsabit, Wajir and Samburu. Laying also took place in Turkana, Moyale, Embu and Kitui districts. The campaign began on the 4th May and ended on the 22nd July, 1946.

An infested area of about 7,400 square miles was operated over by civilian forces numbering 53 Europeans and about 6,500 Africans, using a total of 163 lorries for transport in the field. Bait was of two types, both using a mixture of coffee husk and condemned flour as a basis, but one with sodium arsenite, the other with benzene hexachloride (gammexane) as the poison. 26,688 bags of benzene hexachloride bait and 1,885 bags of sodium arsenite bait were used in this campaign. In addition, 2,068 drums of DNOC were applied as a contact dust against hoppers and adults, this being a particularly useful method for inaccessible areas and against young winged locusts.

Generally speaking, the results of this campaign in Kenya were good and there were few escapes even from the heavy Masai infestation. Several large swarms which had their origin further south did, however, make their way northwards into the Kenya Highlands. Two of the largest of these swarms were broken up by an experimental power dusting unit using DNOC, but some damage to crops occurred, mainly in the Kikuyu reserve and the Kinangop and Thomson's Falls areas and about 2,500 acres of cereals were reported as damaged or destroyed.

PRODUCTION IN NATIVE AREAS—1946
QUANTITIES AND VALUE OF MORE IMPORTANT PRODUCTS MARKETING (PARTLY ESTIMATED)

	NYANZA PROVINCE			CENTRAL PROVINCE		COAST PROVINCE	
	Unit	Quantity	Value	Quantity	Value	Quantity	Value
Maize and Maize Meal	200 lb.	682,068	£ 292,623	993	£ 478	—	—
Millet (including Sorghum)	200 "	73,707	47,158	1,816	1,795	—	—
Wheat	200 "	2,946	2,946	1,064	1,133	—	—
Rice (Paddy)	150 "	14,289	9,645	—	—	10,752	6,336
Pulses	200 "	4,729	7,618	38,665	108,182	4,520	5,720
Potatoes	180 "	4,500	1,740	41,349	43,724	—	—
Cashew Nuts	Cwt.	—	—	—	—	15,035	10,104
Chillies	Cwt.	—	—	—	—	380	1,060
Coffee	Cwt.	1,843	1,600	1,068	3,200	—	—
Cotton (Seed Cotton)	100 lb.	60,622	49,170	—	—	8,784	6,991
Copra	Tons	—	—	—	—	1,783	44,575
Groundnuts	180 lb.	13,292	14,355	—	—	—	—
Sesame	180 "	752	762	—	—	4,320	4,450
Tobacco	Cwt.	—	—	11,113	5,791	—	—
Vegetables, Flowers and Fruit	—	—	8,500	—	—	—	—
Wattle Bark	Tons	40	200	28,701	161,431	—	35,450
Ghee	36 lb.	34,548	43,650	47	153,530	—	—
Eggs	1,000	5,061	19,231	7,232	101	—	—
Total			£499,198		£514,858		£114,686

The Eleventh Hopper Destruction Campaign.—The majority of swarms resulting from the long rains breeding remained in the Highlands until the approach of the short rains in late September, but at least one swarm was known to have reached Samburu from the south by early August, reinforcing the small escapes which occurred in Samburu and Isiolo districts during the long rains breeding. These matured and gave rise to an interim breeding in Samburu (Suguta valley area) and Turkana.

A total infested area of about 1,830 square miles was operated over by 17 Europeans and about 2,850 Africans between the 4th September and the 24th October with 53 lorries for transport in the field. A total of 2,260 bags of benzene hexachloride bait was used, together with 272 drums of DNOC dust. Flooding of the Turkwell and Kerio rivers during the early stages of the campaign gave rise to anxiety that there might be large escapes, since the area between the rivers was inaccessible to transport, but the Turkwell was crossed on the 12th September and the infestation was found to be less heavy than had been suspected and was quickly destroyed.

The campaign as a whole proved very successful; one small swarm of adults which settled in bushes by the Turkwell river was completely eliminated by DNOC dust. Another small swarm entered Maralal district from the direction of the Suguta valley, but these locusts constituted the only known escapes.

The Twelfth Hopper Destruction Campaign.—By the end of September, swarms of the long rains generation had moved out of the Highlands into Samburu and Isiolo districts and the main concentration remained there throughout the short rains breeding season. Other swarms moved into southern Marsabit, Garissa and Kitui and, in addition, there was a very small immigration of mature swarms from Somalia into Mandera, Moyale, Wajir and eastern Garissa districts. One or two swarms also moved southwards as far as Teita district. Initial layings were heavy in Samburu, Isiolo and parts of Garissa district, but there was a high degree of parasitism and many egg deposits failed to hatch.

The campaign began on the 1st November, 1946, and ended on the 13th January, 1947. A total area of 7,394 square miles was infested and 58 Europeans and 6,132 Africans were employed in the destruction of hoppers; 194 lorries were used for transport in the field, working for a total of 6,687 lorry-days. Benzene hexachloride bait, supplemented by DNOC in some areas, was the main form of control and 11,043 bags of the former and 1,791 drums of the latter were used; 760 bags of arsenite bait were also used in the Garissa district. The influx of swarms from Somalia was unusually small and the campaign was of unusually short duration, owing partly to the efficient scouting organization whereby egg-deposits were reported immediately and hoppers therefore tackled promptly in the early stages and partly to the efficacy of the bait used. Results were highly successful and not a single swarm escaped from the known infested areas in Kenya.

Organization of Locust Control.—A very noteworthy fact in connexion with the successful attack on locusts during the year was that it was accomplished with civilian resources only. In the early years of this outbreak, when the decision was reached that locusts must be attacked over the whole of the infested area, it was assumed (and at that time rightly assumed) that this would necessarily entail the employment of military forces for locust destruction. The value in the past of the help given by army units is so well known that it does not need to be repeated here, but the experience gained during the past years by everyone concerned, together with great improvements in the technical methods of destruction, resulted this year in extensive and successful campaigns on an entirely

civilian basis. This highly meritorious result was only achieved by the excellent co-operation of all concerned. The outstanding work of Administrative Officers in directing the district campaigns is well known and must be recorded again.

In the early days, shortages of locust officers, transport and bait greatly increased the difficulties of locust control and resulted in some local breakdowns, but during 1946 it was possible to find and employ a greater number of trained European locust officers and to produce adequate transport, bait and other stores. This enabled the Administrative Officers to direct effective and economical district campaigns in all cases. Finally, the work of native scouts and baiting gangs must be mentioned; this work of Africans is the basis of locust control in Kenya and they have done the job really well over a long period.

Technical advances in locust control and experimental work on baits and sprays are discussed in the Senior Entomologist's Report in Part III.

PART II—POLICY AND THE WORK OF THE DEPARTMENT OF AGRICULTURE

GENERAL

The agricultural policy which the Colony was forced to adopt during the war period, namely the maximum production of foodstuffs and in particular cereals, has remained the policy during the year under review. While this was unavoidable under the circumstances of the general food position throughout the world, the effects of this policy are becoming more and more serious on the land of Kenya with each year that it continues. Both in non-native and even more in native areas continuous cropping of the maximum quantity of land with cereals is draining the fertility, destroying the structure and generally reducing the production capacity of the land. It is natural that this drain on the country's fertility should continue since not only is there an over-riding need for this production but for those who look more to the immediate gain it is a profitable business, but it cannot and must not be allowed to continue for one season longer than is essential. The ill effects on the land are cumulative and are rapidly increasing. In the native lands at least the position is not likely really to improve so long as prices remain at their present levels. We must at the earliest possible moment and by all possible means discourage the excessive planting of maize, although without the maximum production of cereals we shall not remain for the present self-sufficient. If, however, action is taken sufficiently soon and on a sufficiently wide scale and proper restorative measures are undertaken, there is no reason to suppose that when these measures have taken effect we shall not be able to feed the population on local produce. In non-native areas some of the worst affected farms or portions of them have had to be closed under orders issued under the Land and Water Preservation Ordinance. But the somewhat peculiar position exists that though the Director can and does issue closure orders in respect of European farms he is not in a position to do so in the case of landholders in native land units, save with the consent of the District Commissioner. Such consent is liable to be withheld on the grounds of impracticability arising from considerations unconnected with the preservation of the land. There must, however, be a greater appreciation in both areas of the damage that is being done and a real endeavour made by farmers and native cultivators to stop that damage at the earliest possible moment.

While there is as yet no general move in the direction of a radical alteration of farming methods, in some native areas there has been improvement in the application of soil conservation measures. Terracing and manuring are making considerable progress in certain areas. Little is effected elsewhere without continuous pressure on the part of Administrative and Agricultural staff and the majority of the African population appears to be too apathetic to do much effective work without such continued pressure. Cases in point are the thousands of acres of potentially useful grazing in thickly populated and over-stocked native reserves which are allowed to be occupied by weeds such as Mexican Marigold, Sodom Apple and Bracken, weeds which could be easily removed and which, if they were removed, would make way for much needed grazing. Similarly, in the Nyanza Province extreme apathy exists in connexion with the uprooting of Striga. There cannot be an African in the striga area who has not been told and who does not know that striga reduces his crop yield greatly and that it seeds at a very high rate, yet there are but few individuals who would think of pulling it up and destroying it before the seed is set unless pressed to do so by Government staff or even threatened with prosecution.

A particularly disquieting feature in the Central Province is the fact that it is reported that in one or two districts where recommendations for soil conservation and other methods of improvement were being accepted and put into

effect by the people concerned, there has been a set-back in the past year owing to the exhortations of ignorant politicians who set their own political ambitions in front of the improvement of the welfare of their fellows. With the return of the ex-askari to the reserves in large numbers, which men have had opportunities of seeing something of the world outside their own reserves, there should be an awakening of public opinion in those reserves tending to endeavour to bring about improvements. It is regrettable that this does not appear to be forthcoming. The time has arrived when the African must realize that unless he is prepared to look after his land better and to put his back into the work there can be no advance in the prosperity of the agricultural community and the country generally and that the many social services which he now desires will be quite impossible of attainment unless he arrests the present fall in the fertility of his land.

DEPARTMENTAL

The policy of the Department in relation to both non-native and native agriculture was discussed at some length in the Annual Report for 1945. Nothing has occurred in 1946 to make desirable any major change in this policy and hence it is not considered necessary to repeat the discussion this year. It is unfortunately the case, however, that the department has found it increasingly difficult and in many respects impossible to implement its policy as it would desire through continued shortage of staff. The resumption of overseas leave, of which indeed the whole staff was greatly in need, coupled with the absence of any recruiting during the war, has put a heavy strain on the department in trying to keep its various services in operation. Some districts have had to remain without extension officers and the research services have been considerably below strength, particularly the entomological division.

In one or two important directions, however, departmental development can be recorded. For the first time, a Senior Agricultural Officer has been posted to Rift Valley Province to initiate departmental extension work in the backward native reserves and eventually to co-ordinate advisory and experimental work in the settled areas; an officer trained and experienced in horticulture has been detailed for investigational and advisory work on fruit; considerable recruitment of field officers in the Department's Soil Conservation Service has been possible, although it has so far been found impossible to recruit the necessary engineers and surveyors; and, finally, the Egerton School of Agriculture is beginning to take on its desired shape as an institution for higher training in agriculture.

EXPERIMENTAL WORK

Pyrethrum.—Pyrethrum holds the position at present of the Colony's most valuable export crop and much of the time of specialist officers has been devoted to its problems. Approximately one thousand single plant selections were made, both in the high toxic strain and in the bulk crop at the Plant Breeding Station, and isolated plots of the highest toxic selections have been established for seed production. Bulking plots of high toxic strain (14 x 24) were established in the Molo area with the co-operation of farmers, and by the end of the year over a ton of seed was obtained; this was dressed and forwarded to the Pyrethrum Board for distribution to growers. Twenty-six statistical experiments have been established at the Molo Pyrethrum Station and at sub-stations to obtain information on various aspects of cultural practices.

A new bud disease appeared in the Molo area in June; this caused growers considerable alarm as yields suddenly fell off and losses running into several thousands of pounds in value occurred. The disease was later reported from most of the pyrethrum areas in the Colony and, although its intensity tended to

decrease, at the end of the year it was still widely present and attacking newly formed buds and flowers. The disease was studied by the Senior Plant Pathologist and was found to be due to *Ramularia bellunensis* Speg, a fungus hitherto unrecorded on pyrethrum.

The chemical division under the Senior Agricultural Chemist has been largely concerned with methods of pyrethrum analysis. Hitherto this department has used the official method of the Association of Official Agricultural Chemists, but arising out of allegations from the U.S.A. that there was a very marked loss in pyrethrum content between baling at Nakuru and arrival in New York the Seil method was adopted in August. There are, however, peculiar differences between the results obtained here and in the U.S.A., and it has since been ascertained that in the latter country an unpublished modified Seil method is being used. In these circumstances it is difficult to correlate the results obtained here with those obtained in the U.S.A. As a result of a preliminary report upon methods of analysis issued by the Imperial Institute further collaborative work has been undertaken to settle details of the proposed analysis methods. Arrangements have also been made for the carrying out of world-wide collaborative work on methods developed by the Imperial Institute Committee.

Coffee.—Although much still remains to be done and the scientific staff is not expected to leave the Scott Agricultural Laboratories before 1948, development of the new coffee research station at Ruiru has been satisfactory and with the completion of the dairy building in April, 1946, the whole dairy herd was moved out from Nairobi. A uniformity trial was laid down in the area selected for future cultural coffee experiments. Cultural experiments have continued at Kitale and co-operatively on a number of privately owned estates.

The Entomologist of the Coffee Team was unfortunately absent through sickness on overseas leave for most of the year, and there is therefore little or no progress to record in entomological research. The mealybug situation in areas east of the Rift has been kept under close review and generally speaking its control by biological means has been satisfactorily maintained. Some breakdowns in this control have, however, occurred and further research work is required. The Entomologist's spray as a control of thrips has proved extremely effective when operations were correctly carried out.

In investigating flowerbud formation and differentiation, the Plant Pathologist and Physiologist found that more detailed information on the sequence of microscopic anatomical change was needed. Work on the upper Kiambu type of liquor has been continued and the method of assessing liquors, developed in 1945, has been used in a re-examination of liquoring descriptions of samples obtained during past experiments on the leaf crop ratio. Further work has been undertaken on the electrical method of soil moisture measurement first investigated in 1944 and much light has already been shed on the soil moisture relations of coffee.

The coffee team was strengthened in June by the appointment of a chemist, who took early opportunities of visiting most of the coffee areas in the Colony and the Lyamungu Coffee Research Station in Tanganyika. In the field he has devoted attention to the design and layout of statistical experiments at the new Ruiru station and in the laboratory work has been done on the setting up of apparatus for spectographic analysis, the preliminary standardization of colorimetric methods for leaf analysis, and D.D.T. spray-banding against mealybug.

Sisal.—Investigational work on many aspects of sisal production has continued along approved lines at the High Level Sisal Research Station, Thika. This work is under the general direction of the Senior Agricultural Chemist, who

has also begun investigating the recovery of valuable acids from the effluent from the decortication of sisal. It is hoped to adapt for this purpose methods which have been evolved in recent years for the purification of water; these methods make use of materials which remove both bases and acids from the water and working samples of such materials have been obtained.

Cereals.—At the Plant Breeding Station, Njoro, the Senior Plant Breeder has increased selected cultures in the wheat crosses 337, 340, 341, 344, 350 and 351 and has continued the selection of desirable segregates among the cage hybrids. A yield trial showed that most new hybrids have satisfactory yielding capabilities and will out-yield standard varieties. Six new wheats are being multiplied by farmers. Cultures of physiologic forms of stem rust have been maintained by the Senior Plant Pathologist, who has carried out rust determinations and seedling routine tests. The Molo sub-station, in addition to providing an extra testing ground for stem rust, serves as a yellow rust testing station.

The stalk borer of maize (*Busseola fusca*) was present to a serious degree in early planted maize in Trans Nzoia. In order to ensure a period when maize would not be present and thereby to reduce the moth population before the next planting season, legislative action was taken to prohibit the planting of maize between the 1st June, 1946, and the 14th February, 1947. Bionomics of the moth were studied at Kitale under the guidance of the Senior Entomologist and experiments were carried out on various direct control methods. Satisfactory results were obtained from the use of sodium fluosilicate and a preliminary trial indicated that D.D.T. 1 per cent in diatomite would prove an effective dressing and probably superior in results to the old derris extract top dressing as well as being easier to apply than liquid dressings.

Potatoes.—The Senior Plant Pathologist has continued the testing and multiplication of varieties of blight-resistant potatoes from Ireland, Scotland and the U.S.A. Of the potatoes bred by Dr. Black of the Scottish Society for Research in Plant Breeding, 914a (91) and 835a (3) have, since 1944, proved suitable for Kenya conditions and have been put out for multiplication by farmers under agreement with the department. Of the blight-resistant potatoes bred by Dr. Salaman and Mr. Clarke of Ballycastle, Salaman Clarke 2 and the variety Dutch Robyjin have also been issued to farmers, but the last named was attacked by blight in 1946 and is consequently being discarded. Some local potato varieties have been sent for study to the Imperial Bureau of Plant Breeding and Genetics.

Pasture.—An experiment at Rumuruti is showing that red oat grass (*Themeda triandra*) can be managed in that area without the use of fire, provided that the grass is allowed to seed fairly regularly; this result is different from that reached at Ngong, possibly due to the association there of red oat grass with *Digitaria abyssinica*. An experiment on the eradication of wire grass (*Pennisetum schimperi*) has been maintained near Thomson's Falls since 1944; while it is too soon for definite conclusions to be reached, it appears likely that a combination of burning and resting is the solution.

In connexion with the progressive deterioration of star-grass pastures in the Rift, attention has been directed to the management of star grass (*Cynodon dactylon*) in the Rift to prevent the intrusion of the objectionable annual grass (*Aristide adscensionis*) and several investigational trials are being laid down. In addition to these investigation the Senior Agricultural Officer (Pasture Research) has given attention to the production of seed of *Bromus marginatus*, Nzoia Rhodes grass and molasses grass for sowing down temporary leys, the production of a vegetative map of the Horn of Africa and trials of introduced grass and forage plant species.

Scott Agricultural Laboratories.—During the year the Senior Agricultural Chemist took over control of the field work at the Scott Agricultural Laboratories in addition to his duties as head of the chemical division. Several trials were conducted with certain new crops. Mustard has been thought a likely crop for the Kenya Highlands, but owing to attack by various insects it has never been found profitable; most promising crops were, however, obtained in an experiment involving the use of gammexane dust and there were definite indications of a marked fumigant effect by the insecticide which is to be further investigated. English coriander grew well and gave good yields in spite of considerable shedding. Dill, which also did well, should prove a useful crop for lower altitudes either for seed or for essential oil production, but cumin failed in the open. In view of the world shortage of oils, a small plot of safflower was sown, which did very well indeed, and although the previous introduction of safflower may still be remembered it is felt that this crop would at present be highly profitable.

Much of the land had become infested with eelworm and has therefore been put down to long period grass crops, notably the Trans Nzoia Rhodes grass. A very heavy growth of weeds completely covering young Rhodes grass in two fields was destroyed by means of the new hormone type weed killers. Experiments were conducted with these weed killers on carefully surveyed weed infested areas. While most of the common Kenya weeds were destroyed, some were merely severely distorted and were able to flower. These, however, did not set seed at all or set non-viable seed, so that in one season these weed-infested areas were virtually freed from weed growth. In experiments on pyrethrum, most of the weed were destroyed, but the pyrethrum was also very severely affected.

Work upon new insecticides was continued and in experiments in collaboration with the coffee team the very great importance of the choice of the carrier for the insecticide was clearly demonstrated. Field experiments on the use of gammexane were also instituted.

The Senior Agricultural Chemist found that he had no longer the time to devote to the increasing needs of Rural Industries, and this work was handed over to the Directorate of Training.

The main work carried out during the year by the Soil Chemist has been investigations dealing with soil survey and land utilization. A reconnaissance soil survey over some 4,000 square miles was carried out in connexion with the Upper Tana River Irrigation Project. Field work and analysis of soil samples made it possible to classify seven main soil types and to select a site on the peneplain off the left bank of the Tana River, opposite Garissa, as having the potentially most suitable topography and soil conditions for irrigation. The soils were found by analysis to be well supplied with mineral nutrients but to be very low in total nitrogen. Pot culture work confirmed a marked deficiency of available nitrates and showed a marked improvement in plant growth as a result of the addition of nitrogen only or of a leguminous green manure.

Land utilization surveys have also been carried out in the Makueni, Simba, Kibwezi, Chyulu and Trans Mara districts. Apart from the last named area, the critical factor for settlement is whether the rainfall and its distribution over a number of years is adequate to ensure not too many crop failures. Settlement in the greater part of these areas must depend largely on extensive ranching of stock after the clearing of bush and the provision of water supplies. In the 1,100 square mile Trans Mara area, rainfall and its distribution and the presence of fertile virgin soils permit much intensive cultivation and good grazing and the settlement capacity of the area is estimated at 14,000 families.

The infertile Chogoria lands, which have been studied by soil analysis and pot culture work, are not low in organic matter and total nitrogen, but much is present in an inert form so that liberation of nitrates is very slow. The soils show a marked response to nitrogenous plus phosphatic manuring.

The development of a highly citric soluble phosphatic fertilizer by calcining Uganda rock phosphate with Magadi ash has been continued. Though there are technical difficulties in the production of a uniform high grade product in a large plant, it should be possible for farmers to burn a fairly high grade, though not uniform, material in small kilns.

The Entomological division has been seriously understaffed, the Senior Entomologist being largely occupied on locust work with the E.A. Anti-Locust Directorate. A report of the locust campaigns is included in Part I of this report.

Reference has already been made to work on the control of maize stalk borer. Work continued at Kitale on the control of chafer grubs (*Schizonycha* sp.); tests of a gammexane treatment were made, but at the dosages tried the treatment was not sufficiently effective and further trials are necessary. The prospects of an economic control in the field with this material are not at present very promising.

Destruction of termites in the field has been further studied. Gammexane products in the form of smokes and dust have not proved generally effective. Trials are in hand of the resistance to termite attack of locally made building boards treated with white ant proofing materials.

The work of operating the Plant Protection Ordinance is largely under the control of the Senior Entomologist, with the collaboration of the Chief Grader and Inspector, Mombasa. Both applications for plant importation permits and importations were more numerous than in 1945 and very large numbers of fruit trees and other plants were inspected in Nairobi. Several different species of insect pests were intercepted and some imported trees had to be destroyed. The total prohibition of the importation of herbaceous ornamental plants on account of the danger of introducing the spotted wilt disease of tomatoes and other crops remained in force and was adopted also by Uganda and Tanganyika Territory.

It is much to be regretted that in spite of the fact that the Plant Protection Ordinance has been in operation for many years and that reminding notices appear from time to time in the Press, many members of the public fail to apply for permits for the importation of plants and seeds. It is in the interests of the Colony as a whole that plant importation regulations are imposed and it is to the advantage of an importer to obtain a permit, as only thus may he become aware of the inspection certificate which may be required from the country of origin. Much annoyance and distress to importers, as well as the expenditure of time by the staff of the department, could be avoided by strict compliance with the regulations.

Reference has already been made to the work of the Senior Plant Pathologist in connexion with pyrethrum, wheat and potatoes. Attention has continued to be paid to forestry diseases on behalf of the Forestry Department.

The Senior Plant Pathologist has continued to develop and maintain the seed testing laboratory which is established at the Scott Agricultural Laboratories. Further apparatus has been acquired from the United Kingdom and the U.S.A. and the laboratory is now fully equipped in this respect to undertake a full seed testing programme for the Colony. Some three hundred samples of vegetable and grass seeds, pyrethrum and cereals were tested during the year for the Seed Specialist, the Senior Agricultural Officer (Pasture Research) and the Pyrethrum

Board. In general, the Continental method of analysis is followed; in all samples except the grass seeds and pyrethrum the impurities found were negligible.

Other botanical work carried out included the identification of botanical samples, weeds and weed seeds and the building up of a collection of seeds of indigenous and introduced weeds for identification purposes.

The Plant Breeding Station, Njoro.—The Senior Plant Breeder's work in connexion with wheat and pyrethrum breeding has been referred to above and is discussed in detail in his sectional report in Part III. Attention was also directed to barley and oats trials. Of several barley varieties tested, Glacier, developed in the U.S.A., is a most successful yielder under Njoro conditions and is to be multiplied in 1947; its good straw resistance to leaf blotch and its plump grain make it of distinct promise as a feeding barley, but the 1945 crop, although it had a low nitrogen content, was unsuitable for malting. Other varieties are also promising and trials will continue.

Six new oats from Canada were grown for the first time. All had a very good straw and stood well and as they are awnless they should be suitable for milling, but only the two which showed resistance to stem rust will be carried on.

Experiment Stations, Kitale and Ol'Joro Orok.—The farm rotation at the Kitale experiment station has been replanned, as it was found that even with heavy applications of farmyard manure and green manuring the fields which had been under annual crops for a period of years were beginning to go back; applications of manure were having only a temporary effect and run-off water from terraces was increasing in volume due to deterioration of soil structure and absorptive capacity. The following six-year rotation has therefore been adopted for the 160 acres of arable land: maize, fodder, maize, grass, grass, grass, fifteen tons of farmyard manure being applied to the fodder and the second maize crop being underseeded with grass.

The building programme was started at the new experimental farm at Ol'Joro Orok and living quarters were nearly completed by the end of the year. Investigational work has continued at both centres and at certain sub-stations on permanent pastures and temporary leys, cereals, pyrethrum, potatoes, fertilizers and weed and pest control.

In statistical fertilizer trials, silicophosphate at the rate of 185 lb. per acre produced a 92 per cent increase in yield of rye at Kitale and 59 per cent increase in yield of wheat at the Eldoret sub-station, compared with no fertilizer. This result was supported by observations in preliminary trials undertaken at Ol'Joro Orok. Further details of this and other investigational work will be found in the reports of the Senior Agricultural Officers concerned in Part III.

FRUIT

At the invitation of the Kenya Government, Dr. R. H. Marloth, Officer in Charge of the Nelspruit Sub-tropical Horticultural Research Station, Transvaal, visited Kenya for three months early in 1946 to investigate and report on the Colony's potentialities for fruit production. Dr. Marloth's report is being printed and will be on sale to the public.

In pursuance of the policy of devoting more attention to fruit growing than it has been able to do in the past, the department has detailed an horticultural officer solely for this work and a fruit experiment station is being established at Molo and sub-stations at other centres. A full report of the work done in 1946, with a discussion on the industry, will be found in Part III.

One of the major problems to be investigated is that of prolonged bud dormancy, due to deciduous fruit trees not being subjected to sufficiently cold conditions during their period of dormancy. Two lines of approach to the solution of this problem are the breeding of stocks whose chilling requirements are satisfied by temperatures no lower than those experienced in this country and the artificial breaking of the dormancy by spraying with organic or mineral oils. Work along the latter line has already been instituted.

Another important line of investigation is into the question of rootstocks. The Northern Spy rootstock, hitherto largely used in Kenya for apples, is no longer considered desirable on account of its slow growth and unproductiveness, although it is highly resistant to attacks by woolly aphis. Trials have been started of several clonal rootstocks imported from the East Malling Research Station and a large number of rooted layers has been propagated for trial graftings of apple varieties in due course.

VEGETABLE SEED PRODUCTION

An account of the early development of the seed industry during the war years was given in the Annual Report for 1945. The industry has continued to develop under the guidance and advice of the department's Seed Specialist and contracts were made by forty-three Kenya farmers with five United Kingdom firms of seed merchants in respect of seeds to be grown during 1946. The acreages involved amounted to 374 acres and the yield of seeds was estimated to reach of total of nearly 4,000 cwt. of vegetable seeds and $12\frac{1}{2}$ cwt. of flower seeds, valued at £14,633 and £736 respectively. Unfortunately, the United Kingdom firms experienced some difficulty in securing import licences for these seeds from the home government; this was particularly the case with certain flower seeds, and at the end of the year it appeared likely that considerations of high policy in connexion with international trade agreements would put at least a severe check on some aspects of this growing industry.

The Seeds Advisory Committee met several times during the year and drafted legislation for a proposed Seeds Ordinance to make proper provision for the control and direction of this industry and to safeguard farmers and gardeners in the Colony against being supplied by seed growers or merchants with unclean or poor quality seed. A draft constitution for the proposed Seed Growers' Association was also prepared.

EXTENSION WORK

Non-Native Areas.—Agricultural Officers in European areas have continued to devote a large part of their time to work in connexion with the Increased Production of Crops Ordinance, but the pressure of this work has not been quite so heavy as in recent years. General advisory work continues to increase, however, and in addition to the organization of a number of farmers' days and attendance at meetings of farmers' associations, departmental officers made several hundreds of visits to farms in connexion with general or special farming problems.

Native Areas.—The duties of an agricultural officer posted to a native reserve, frequently the only technical agriculturalist for two hundred thousand people or more, are so many and various that it is well nigh impossible to describe them. Development teams have now been established in most districts and often there are also local agricultural committees. The organization and control of marketing and produce inspection always demands a considerable and, in many cases, disproportionate amount of an officer's time, while the constant pressure required to maintain production at a high level and at the same time to conserve and

safeguard the soil resources of the district absorbs much of his energy. Thus, an officer has far too little time for what may be described as purely* agricultural extension work, that is the teaching and encouragement of better farming methods, and little or no time for investigational work. For his contact with the peasant the officer is dependent on his staff of trained Agricultural Instructors, and although these have given sterling service in the past it has been clear for a long time that both a raising of their standard of education and capacity and an increase in European staff to direct and supervise their activities are vitally necessary to attain that progress which is necessary before native farming can be established on a sound economy.

The department's million and a half pound scheme for soil conservation and general agricultural development provides for an increase of fifty subordinate European officers in native areas; the filling of these posts is, however, extremely slow, as the majority of candidates coming forward have not sufficient agricultural experience and background and have to have considerable training before they can be posted to districts. Even if they were plentiful, however, there is still utterly insufficient housing in which they could be accommodated. With regard to African staff, it is the department's immediate aim to insist on at least the passing of the primary examination as a qualification for entry to its training schools. The next aim, however, is a Junior Secondary standard for entry as soon as possible and ultimately a School Certificate, but at the present rate of progress it is feared that even the former will require many years for its achievement.

That there is a brighter side to this rather depressing picture is evident from the report of the Senior Agricultural Officer, Central Province, in which he says:—

"There are, however, two encouraging features. The first is an increasing realization of the value of manure. In Kiambu, although the system of manure supply in use last year had to be abandoned through tardy payments, it has caused many people to obtain their own supplies or to make it themselves. In Fort Hall, many new cattle sheds are being erected every month."

Even from Machakos there is heartening news. The Agricultural Officer writes:—

"During the year there has been a most welcome change in outlook towards the use of *boma* manure, especially in the northern locations, and the practice of using manure in Kangundo and Matungulu locations is now almost general in all fields."

The second encouraging feature is an increasing number of good individual efforts in paddocking and the intelligent use of beasts and grass. Of one farmer in particular the Assistant Agricultural Officer, Kiambu, writes:—

"J. N. Kamau has a small farm split into three paddocks with a small food *shamba*. The grazing probably comprises five acres and on this he carries four grade cows, one grade bull and two head of young stock. Calves are kept separate and get at least one gallon of whole milk a day. When asked when he was going to buy some more cows, he indignantly pointed out that were he to do so there would not be enough grass for them or the ones he already had."

SOIL CONSERVATION

Considerable expansion took place in the Soil Conservation Service of the department during the year, largely owing to the engagement of ex-servicemen as Assistant Soil Conservation Officers and the arrival of some, albeit so far

inadequate, supplies of machinery. In European areas 7,293 acres of land were broad base terraced and 338 acres were narrow base terraced on a total of 133 farms, 55 of which were in the Nakuru area. Nearly 35,000 cubic yards were excavated by handwork and 66 miles of outlet and cut-off drains were constructed. Five dams were built in the Trans Nzoia and Plateau areas with a total capacity of 104 acre-feet.

The survey of the Rongai Valley drainage scheme was completed early in the year and the Italian survey party carried out other valuable surveys in Thomson's Falls and Kitale before its services ceased to be available in the third quarter of the year. Under the direction of the Soil Engineer other surveys were made by departmental staff, but quite inadequate supplies of equipment made progress in this direction much slower than desirable.

The Inspector and River Scout organizations have continued to operate satisfactorily. The provision of Inspectors enabled valuable work to be done in the safeguarding of river banks and the prevention of pollution of rivers and in bringing to the attention of departmental officers unfavourable conditions existing on many farms which were leading to deterioration in productivity, sometimes of a permanent nature.

Only slow progress can be recorded in the establishment of the six soil conservation district headquarters which it is intended should serve the main European farming area. The Kitale, Thomson's Falls and Lumbwa stations were partially completed by the end of the year, but the department had been unable to secure land for the Nakuru and Eldoret stations, while development of the Nairobi district headquarters was in abeyance pending a sufficient increase of staff and equipment to enable soil conservation work to extend to that district.

In Nyanza Province the continued drive for maximum cereal production has worked against any long term plan for the conservation of the soils of the province. Broad base terracing continued in Kitosh, where 79 acres were completed with nine miles of terrace, and narrow base terracing was carried out in the more thickly populated southern locations of North Kavirondo. In Kericho the Kipsigis have made good progress in contour ploughing and the leaving of unploughed contour strips of grass. Trash line laying is practised throughout most of the Kisii highlands and is spreading to the Luo locations.

Substantial progress was made in Central Province during the year, particularly in Fort Hall district, where nearly 7,000 miles of terrace were constructed. Kiambu and Machakos also made satisfactory progress, but political opposition and laziness prevented much advance in South Nyeri and Kitui. The failure of the South Nyeri people to adopt soil conservation measures is now causing them grave danger. In the more enlightened areas of the province there has been evidently an improvement in the art of terrace making and in the maintenance of terraces. Good progress is also reported in grass planting, particularly in Fort Hall, Kiambu and Meru; in Fort Hall the bare eroded hillsides have almost been covered and it was found possible to open some reclaimed areas to controlled grazing. In Meru, a considerable increase in pasture area has been achieved by the clearing of bracken.

Apart from the Teita hills, where over 1,200 miles of contour trash lines were laid and 33 miles of terraces constructed, soil conservation work in the Coast Province has been mainly confined to the protection of river banks by the prohibition of cultivation, the control of grass fires and the general protection of cover in catchment areas.

Reference has already been made to the posting of a Senior Agricultural Officer to the Rift Valley Province, and progress is already being made in consolidating the work done in the past by officers of other departments in the

various native reserves, and schemes under the African Settlement and Land Utilization Board are already under way. Steady and co-ordinated progress in these scattered reserves will not, however, be possible until an adequate staff of Agricultural Instructors of a higher standard than hitherto is available with an adequate resident European staff in the districts to direct their activities and to win the co-operation of the Africans, without which nowhere can any real advances be made.

AGRICULTURAL EDUCATION

The wartime use of the Egerton School of Agriculture as a boys' secondary school came to an end in July, 1945, and the school was got ready to take up its proper role of an agricultural institution equipped to prepare young men and women of the Colony as farmers. For a few years, however, before this can be done it is being called upon to give intensive foundation courses in farming to ex-servicemen under the settlement schemes and newly recruited officers of the department. During the latter half of 1946, 47 students were in residence, many of them with their families. To meet the needs of this training the staff at the school has been considerably increased, and to accommodate both staff and students a comprehensive building programme was undertaken. In addition, the Settlement Hostel was taken over by the department to accommodate the married students.

In order to provide as many tuition facilities as possible, the work on the school farm is of a more varied nature than would normally be met on a commercial farm. Crops grown during the year included wheat, maize, barley, rye, oats, vetches, flax, linseed, mangolds, pyrethrum, lucerne, potatoes and vegetables, as well as temporary leys. Live stock included a grade Ayreshire and Friesian dairy herd, a foundation Boran herd, pigs, Romney Marsh sheep, horses and flocks of Rhode Island Reds and White Leghorns. The gross return of the farm during the year was some £3,000.

The agricultural education which the department can provide for Africans is still entirely inadequate. A start was made on the erection of buildings for the new school at Embu to replace the temporary school which the Agricultural Officer is with great difficulty continuing to run in addition to his normal district duties, but very little progress has been made. No progress can be reported with regard to the proposed Maseno School, and the department's agricultural training for Nyanza Province is still centred at Bukura, where 30 first-year and 31 second-year apprentices were in residence during the year.

PRODUCE MARKETING AND INSPECTION

The European staff in Nyanza Province has been strengthened by the appointment of a marketing officer in each of the four districts; these appointments have relieved the district agricultural officers of much routine work and have enabled the control of produce from the initial purchase to delivery to the Control to be intensified. The value of these appointments may be assessed in the light of the following remarks of the Senior Agricultural Officer, Central Province:—

"There has been a large increase in demand for trading plots and a good deal of officers' time is taken up with this. In some cases the proportion of time spent on marketing matters is far too great, particularly in South Nyeri, where the Asian assistant did little else. Much of this work has little or nothing to do with the disposal of agricultural products, and when an officer in charge of a district is unable to attend to his agricultural work because he has to spend all his time allocating plots for hotels and carpenters' shops the position is absurd. The sooner the agricultural staff can be released from this work the better will be the agricultural progress made."

Reasonably rigid inspection of maize has been continued in Nyanza, but grading, introduced in October, 1945, and subsequently abandoned, was not re-introduced as it was felt that grading would reduce the amount of maize marketed; this would have been most undesirable during the present general cereal shortage. Ten commodities were subject to inspection and a total of 796,283 bags were inspected in the province; of this quantity 682,068 bags were maize.

In Central Province, owing to local food shortages and the consequent prohibition of exports from most districts, there was again little produce to be inspected. Produce inspectors were largely engaged in trying to check illegal trade. Some 29,000 tons of wattle bark passed through inspection centres, the quality of the bark falling off from its usual high standard during the latter half of the year owing to wet conditions and over-eagerness to sell.

GRADING, INSPECTION AND COOL STORE SERVICES

Although nearly 200,000 bags of maize were exported in 1946, most of this was to "local" ports and the department was not called upon to grade more than 1,145 bags. No wheat was presented for grading, but 16,103 bags of commercial beans, 398 bags of seed beans and 62,282 cwt. of potatoes were presented for grading. The Kilindini conditioning plant worked for over 950 hours and 43,361 bags of produce were treated by heat, while 12,061 bags of produce, mostly seed beans, were fumigated. The conditioning plant, Nairobi, treated by heat 17,508 bags of maize and wheat.

The Government Cool Stores, Kilindini, continued to operate very satisfactorily, the total weight of deposits, 1,560 tons, being nearly 50 per cent greater than in 1945. The greater part of this increase consisted of butter, of which over 30,000 cases were deposited. The demands on space by H.M. Forces have fallen off, but the increased flow of shipping through the port has stimulated ships' store trade, while increased deposits have also been made in connexion with the export of bacon to India and the import of fresh fruit from South Africa.

LIBRARY

A new and experienced librarian was appointed during 1946, the post having been filled by temporary appointments for some time previously, and every endeavour is being made to bring the library up to date and to make up the leeway of the war years when new books were largely unobtainable. In addition to the 112 books added during 1945, the library has been increased by the purchase of a further 125 volumes and many book orders are still outstanding. It is gratifying to record that increasing use is being made of the library, particularly by farmers and others who are not members of the department. By departmental regulations a cash deposit is required before books may be borrowed and the number of new depositors during 1946 was 68, bringing the total number to 194.

PUBLICATIONS

The following is a list of articles contributed by departmental officers to the *East African Agricultural Journal* and to the *Monthly Bulletin of the Coffee Board of Kenya*.

East African Agricultural Journal

VOL. 11—JANUARY-APRIL.

"Bukura Native Agricultural School, Nyanza Province, Kenya"—E. L. Bradford, Senior Assistant Agricultural Officer.

"Goats, Fire and Blowing Sands"—Colin Maher, Senior Soil Conservation Officer.

"Growth and Bearing Habits of *Coffea arabica* in Kenya and in Southern India"—R. W. Rayner, Plant Pathologist/Physiologist.

VOL. 12—JULY-OCTOBER.

"Bacterial Canker of Tomatoes in Kenya"—R. M. Nattrass, Senior Plant Pathologist, and A. Ciccارنة.

"Bacterial Wilt Disease of the Potato in Kenya"—R. M. Nattrass, Senior Plant Pathologist.

"The Eucalyptus Weevil in East Africa"—D. K. McE. Kevan, Entomologist.

"African Mixed Farming Economics as applied to Bukura, Nyanza Province, Kenya"—E. L. Bradford, Senior Assistant Agricultural Officer.

"Conversion of Veld Grazing into Ley Pastures in the Kenya Highlands"—J. M. Nightingale, Sasumua Estate, Kinangop, and H. T. Lloyd, Assistant Agricultural Officer.

Monthly Bulletin of the Coffee Board of Kenya

"The Mealybug Position"—M. Halcrow, Agricultural Officer.

"The Common Coffee Mealybug"—(Extract from Annual Report of Entomologist (Coffee Services), 1945).

AGRICULTURAL LEGISLATION

The following comprises the more important legislative changes affecting agriculture in 1946:—

COFFEE (MARKETING) ORDINANCE, 1946.—Provides for the establishment of the Coffee Marketing Board; prohibits the export and sale of coffee except through the Board; empowers the Board to order coffee to be cured and to classify samples; defines the powers of the Board to sell coffee; provides for the establishment of the "Coffee Pool", the Standing Joint Committee and the Advisory Panel.

PASSION FRUIT (AMENDMENT) ORDINANCE, 1946.—Provides for the licensing of persons who grow more than five acres of passion fruit; prohibits the sale of passion fruit except to agency or under permit.

COFFEE INDUSTRY (AMENDMENT) ORDINANCE, 1946.—Amends the provisions of the principal Ordinance regarding election of members to the Board; provides for the establishment of the Coffee Licensing Advisory Committee; empowers Board to grant licences and to have custody of the coffee levy fund.

PYRETHRUM (AMENDMENT) ORDINANCE, 1946.—Adds to the powers to make rules that of prescribing the areas to be planted with trees and the types of trees to be planted.

Other legislation enacted during the year was as follows:—

Ordinances

An Ordinance to Amend the Sisal Industry Ordinance, 1945.

An Ordinance to Amend the Sugar Ordinance.

An Ordinance to Control the Sale, Cultivation and Consumption of Miraa.

An Ordinance to Amend the Increased Production of Crops Ordinance, 1942.

Rules and Regulations

Native Produce Improvement and Inspection (Amendment) Rules, 1946: Emergency Laws, Acts, etc.: Control of Maize Regulations, 1944: Amendments to Increased Production of Crops Ordinance, 1942: Acreage Grants for; Maize Rules, 1946, Appointment of Agents; Guaranteed Minimum Return and Grants Rules, 1946. Land and Water Preservation Ordinance, 1943: Advances Regulations, 1946. Land Control Ordinance, 1944: Appeal Tribunal Rules, 1946. Pig Industry Ordinance, 1945: Appeals to Governor in Council Rules, 1946; Forms of Licences Rules, 1946. Plant Protection Ordinance, 1937: Amendment Rules, 1946. Pyrethrum (Amendment) Ordinance, 1943: continuation in force. Sisal Industry Ordinance, 1945: Cess on sisal fibre; Registration Rules, 1946. Suppression of Noxious Weeds Ordinance, 1935: Noxious weeds.

STAFF

The Deputy Director acted as Director during my absence from the Colony for a short period in February and March and again from the end of June until the end of the year.

The Director continued to serve throughout the year as Chairman of the East African Anti-Locust Directorate and Dr. Le Pelley remained a member.

Mr. H. Wilkinson, Senior Entomologist, who had proceeded on leave pending retirement in 1945 was succeeded by Dr. R. H. Le Pelley on promotion in March. Mr. R. J. Lathbury retired in July after many years' service, first as Agricultural Officer and latterly as Senior Plant Breeder; he has been succeeded by Mr. H. C. Thorpe on promotion. Mr. N. D. Spranger proceeded on leave pending retirement in December after twenty years' service as Agricultural Officer; Mr. M. Halcrow, O.B.E., transferred to Barbados, and Mr. A. E. Pound was seconded to Seychelles. Additions to the department's field staff included six Agricultural Officers, three being transferred from other colonies and three being new appointments from the United Kingdom.

The staff of the department remained considerably below the established strength during the year.

The cessation of hostilities, far from lightening the burden carried by the staff, has resulted in increased calls on their energies after six years of work at high pressure. To all these calls a magnificent response has been made.

I would express my most sincere thanks to all members of the staff for their hard work, loyalty and devotion during this difficult period.

D. L. BLUNT,
Director of Agriculture.

16th July, 1947.

PART III—SECTIONAL REPORTS

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, NYANZA PROVINCE, 1946

Staff

(a) Europeans.

KISUMU.

Mr. J. T. Moon. Ag. S.A.O.: Jan. 1st to June 23rd.
Mr. J. F. Ward. Ag. S.A.O.: June 24th to Dec. 31st.
Mr. G. C. Javens. A.A.O.: Jan. 1st to Aug. 13th.
Mr. A. F. Nichols. A.O.: Aug. 14th to Sept. 8th.
Mr. J. F. Dearden. A.A.O.: Nov. 1st to Dec. 31st.

KAKAMEGA.

Mr. G. W. Anderson. A.O.: Jan. 1st to Dec. 31st.

MASENO.

Mr. P. R. Akehurst. A.O.: Jan. 1st to April 9th.
Mr. G. C. Javens. A.A.O.: April 10th to Dec. 31st.

KISII.

Mr. A. W. Thompson. A.A.O.: Jan. 1st to Oct. 23rd.
Mr. A. F. Nichols. A.O.: Oct. 24th to Dec. 31st.
Mr. J. F. Dearden. A.A.O.: May 30th to Oct. 31st.

KERICHO.

Mr. W. J. Corkhill. A.A.O.: Jan. 1st to Aug. 23rd.
Mr. G. Gamble. A.A.O.: Aug. 24th to Dec. 31st

BUKURA.

Mr. E. L. Bradford. A.A.O.: Jan. 1st to June 12th.
Mr. G. M. Lavers. A.A.O.: June 13th to Dec. 1st.
Mr. E. L. Bradford. A.A.O., Dec. 2nd to Dec. 31st.

(b) Africans.

The Province has three Makerere trained African Agricultural Assistants one each in North Kavirondo, Central Kavirondo and South Kavirondo. The Staff of Instructors was greatly increased due to the transfer of all Local Native Council Instructors in receipt of Sh. 40 per month or more to the Department. The amount of work in connexion with African Staff matters continues to increase and if such matters are to receive the full attention, which is desirable, further European assistance at Provincial Headquarters is necessary.

Details of African Staff are as follows:—

<i>Designation</i>	<i>A.D.</i>	<i>L.N.C.</i>	<i>Total</i>
Agricultural Assistants	3	—	3
Clerks	8	—	8
Instructors	168	—	168
Agricultural Inspectors	—	216	216
River Scouts	40	—	40
Produce Inspectors	13	146	159
Market Staff	—	41	41
Labour	108	389	497

Seasonal Conditions

A prolonged and hot dry season followed a partial failure of the 1945/46 Short Rains. In the second week of April rains became general and in many places they were excessive and caused water-logging. A dry spell occurred in July but rains broke again in August and continued up to mid-December, with a small break in November.

(a) Food Crops.

Nowhere have harvests been insufficient to meet internal food requirements. After a late start in April the rains were well distributed throughout the year so that both Long Rains and Short Rains Crops benefited.

There is danger that the Maragoli and Tiriki may sell more than they can afford to do with the result that at a later date they will have to buy from other areas at a greatly increased price.

Further extensive areas of roots were planted particularly in Central and North Kavirondo. It is proposed to offer to purchase dried cassava from the 1945 plantings. The Kisii Highlands and Kericho District still have a long way to go to make good their inadequate reserves of root crops.

(b) Rainfall.

Place	Average Rainfall in Inches (B.E.A.M.S.)	Number of Years of Records (B.E.A.M.S.)	1946 in Inches
<i>North Kavirondo.</i>			
Kakamega	74.83	24	87.85
Bukura	66.56	21	80.89
<i>Central Kavirondo.</i>			
Maseno	59.40	11	76.64
Kisumu	45.09	42	53.14
<i>South Kavirondo.</i>			
Kisii	67.07	34	68.03
Karungu	—	—	36.36
Homa T.C.	—	—	43.54
Nyakururu	90.99	3	104.86
Murumba	93.30	3	99.15
<i>Kericho District.</i>			
Kericho	70.98	40	65.11

Cotton

1945-46 Season.—A rather larger acreage was planted in all areas than in the previous year. The variety N.17 was discarded and a new variety B.P.52 introduced. Germination and early growth were very satisfactory and growers were unanimous in their favourable comments concerning the new variety. Later, however, very considerable boll-shedding took place and it became obvious that yields were likely to be light. Considerable dissatisfaction was felt by growers in that they considered the loss of crop was due to the change in seed. This was not shared by members of the Department or by the Entomologist of the Empire Cotton Growing Corporation, who paid a visit to this Province.

The following were the quantities of seed cotton purchased during the season:—

No. 1 Area	.. ..	4,440,708 lb. seed cotton
No. 2 Area	.. ..	422,352 „ „ „
No. 3 Area	.. ..	1,199,096 „ „ „
Total	..	6,062,156 lb.

An increase of 286,949 lb. on the 1944/45 crop.

1946-47 Season.—Owing to a general dissatisfaction with the results of the 1945/46 season, there was much reluctance amongst growers to open up new land and as a result planting was late and the acreage is not up to average. A dry July hampered sowing, but with ample rains continuing into December the late sowings have made good growth. The early crop in all areas has been badly damaged by Stainers and Boll-rots. *Lygus* was common in No. 1 Area in the early part of the season. The continuation of the rains has allowed a good late crop to form but much of this is likely to be stained. The Samia location of No. 1 Area is in spite of these set-backs producing an excellent crop.

Coffee

(a) *Arabica*.—South Kavirondo.

Area	Variety	At 1/1/46		At 31/12/46	
		No. of Planters	Acres	No. of Planters	Acres
Bassi ..	Gethins	32	25.61	33	25.82
	J.B.M.	15	28.44	15	30.72
Nyaribari ..	Kents	1	0.17	1	0.17
	J.B.M.	15	45.40	58	51.68
Kitutu ..	Kents	—	4.00	—	4.00
	Various	1	0.75	1	0.75
	J.B.M.	189	72.78	204	76.13
Totals ..		290	177.15	312	189.27

Climatic conditions were good and a satisfactory crop was produced. Baiting of *Antestia* with Sodium Arsenite-Sugar bait was carried out on a larger scale than usual, apparently with good results. Coffee pruning is still carried out by the Department's staff. The care of the plantations was on the whole poor.

Production was 206,463 lb. cherry, nearly all of it being from the 1946-47 crop picked in the last quarter. The value of the crop was approximately £1,600.

Oil Seeds

(a) *Groundnuts*.

Central Kavirondo.—Very little interest has been taken in this crop. Weather conditions were generally favourable and the internal price was high. It has not been possible to obtain a harvesting return as nearly all the crop was consumed locally. A very small amount was sold to Control.

South Kavirondo.—An increase in acreage was obtained by the sustained efforts of the native staff. The crop was generally excellent in spite of a period of drought in July. Much of the crop went to satisfy a large internal demand at prices considerably above those offered by Control.

(b) *Simsim*.

North Kavirondo.—A fair crop was harvested in January and February, but little, however, appeared on the market. Excellent rains occurred during the growing period of the present crop and planting was extensive. Yields promise to be good.

Central Kavirondo.—Interest in simsim remains small. However, under favourable weather conditions a certain amount is likely to come on to the market.

South Kavirondo.—High prices for Kunde and Choroko have resulted in a very small area being planted to simsim, and the surplus for sale will be negligible.

Maize

North Kavirondo.—A slightly larger area was planted with maize, but with increasing soil exhaustion notably in the Kitosh area, the surplus available for sale to the Control is not likely to be any larger than in the previous year. Wet weather at harvest has caused a certain amount of rot.

Central Kavirondo.—Rains were rather tardy in breaking and in Alego, Gem and Seme locations it was necessary to replant. Once rains broke in April planting was general and excellent crops have been obtained. A very considerable increase in the surplus sold along the Branch line has taken place.

A satisfactory Short Rain crop is maturing.

South Kavirondo.—It is estimated that the acreage planted is about 20 per cent higher than in the previous year, and a considerably increased surplus has already appeared on the market. The continued wet weather has caused a certain amount of ear rot.

Kericho.—The area under maize was much the same as in the previous year. In Belgut and Sotik much of the crop was sown late. The Buret crop is poor, owing to soil exhaustion. There was also a partial failure in the lower areas of Sotik. Heavy rains at harvest caused a certain amount of ear rot.

Mtama

North Kavirondo.—The area under mtama remained approximately the same as in 1945. But good Short Rains allowed an excellent ratoon crop to be harvested in Maragoli.

Central Kavirondo.—The 1946 crop was the best which has been reaped for several years. Excellent crops were seen throughout the Kano plains, but although weather was favourable for ratooning none was seen on these plains.

South Kavirondo.—An excellent Long Rains crop has been reaped throughout the district. Sales were heavy during the last four months of the year. The ratooned crop in the Kisii Highlands was also good. As usual the Luo have sold very little of their crop. Good crops of mtama throughout the Province have more than made good the scarcity due to a series of poor years culminating in 1945.

Wimbi

North Kavirondo.—There was no expansion of this crop. Weather was favourable and an average crop was obtained.

Central Kavirondo.—A good crop was harvested but very little came on to the market as most of it has been either stored or used locally. The prices offered by tembo-makers are considerably higher than the Control price.

South Kavirondo.—Good crops were obtained from the Kisii country and from the higher Luo locations, in spite of some loss from heavy rains during the last quarter of the year. The amount disposed of to the Control was almost twice that sold in 1945.

Kericho.—A considerably increased acreage was planted in all locations. Excellent crops were harvested in the Chebalungu area, but blast due to excessive rain was considerable, notably in Belgut.

Pulses

(a) Beans.

North Kavirondo.—The supply of seed is still not satisfactory and although producers are encouraged to save seed they habitually sell all their beans. The Short Rains crop was good in the Central and Southern locations, in spite of hail damage. Little is likely to be sold to the Control.

Central Kavirondo.—Crops have been fair but the greater proportion will be consumed locally.

South Kavirondo.—There has been no appreciable increase in the acreage planted to Short Rains crop of beans. Little, if any, will reach the Control owing to a large local demand and high internal prices.

(b) *Gram (Choroko).*

The greater portion of this crop is grown in South Kavirondo, where the acreage is about the same as in 1945. A satisfactory crop was harvested.

(c) *Cowpeas.*

South Kavirondo.—This commodity is not controlled and the attractive prices of the past two years have encouraged a satisfactory area to be planted in the Short Rains. Owing to favourable rains yields are good and it is anticipated that at least 350 tons will be sold.

Rice Paddy

North Kavirondo.—The crop this year has not been up to average. Owing to the dry period in January and February planting was delayed. This coupled with excessive weed growth reduced yields considerably. Sales commenced in September, but after a good start dwindled rapidly and buying ended in early December. At the close of buying some 10,574 bags of paddy had been delivered to Control. An increasingly large quantity each year finds its way on to the black market.

Central Kavirondo.—A small crop was sold at the two centres, Lugari and Umweri, but lake shore production in the Port Victoria area was most unsatisfactory owing to it being constantly eaten down by hippo. Rice trials were also carried out in the Sio Port area and proved satisfactory. With suitable control of hippo a considerable acreage of the lake shore and of neighbouring swamps could be successfully utilized for rice production.

Production in the Kanos is extremely disappointing. Even to maintain the small areas in cultivation, continuous pressure is needed.

The total production from Central Kavirondo delivered to the Control was 3,715 bags.

South Kavirondo.—This is no longer grown as a cash crop; a little is still grown for local consumption. An interesting practice of ratooning the crop has been developed locally with very fair results.

Potatoes

South Kavirondo.—Yields were good and disease was negligible. Restriction in buying and variation in prices caused uncertainty amongst growers, and a considerably reduced quantity was offered for sale.

Kericho.—The effect of closing buying in 1945 by the Potato Control with little warning has greatly reduced the area under this crop during 1946. The crop was generally very free from disease.

Wheat

South Kavirondo.—The acreage under wheat remained about the same as in 1945. Yields have been good from the two main varieties grown—Kenya Governor and 291. Probably owing to the wet weather the quality has dropped badly. There is room for considerable expansion in the cultivation of this crop, but this is unlikely to come about, until the Kisii can be persuaded to eat wheat themselves.

Kericho.—There has been an increase in the acreage under wheat. The harvest of the early crop was good, but much of the later plantings has been damaged by excessive rain.

Rye

None is now grown.

Root Crops

North Kavirondo.—Throughout the year pressure has been maintained to increase the acreage under cassava and sweet potatoes. During the first three months dried cassava roots amounting to 23,991 bags were purchased to provide an outlet for excess roots and to encourage harvesting and replanting the crop. Replanting was extensive and the position in Marach, Buhayo, Itesio, North Wanga and Malakisi is satisfactory. Elsewhere reserves are still not adequate.

Central Kavirondo.—Purchase of dried cassava roots amounted to 13,413 bags. Considerable propaganda on the planting of famine crops has had a most satisfactory result and extensive new areas of cassava were planted during the year. The area under root crops in the Kanos is still inadequate.

South Kavirondo.—Progress continues slowly. A satisfactory area of sweet potatoes has been planted, but little result has occurred from continued propaganda to plant cassava.

Kericho.—Very little progress has been made in the campaign to plant more cassava and sweet potatoes, a suitable variety of the latter for high zones has not yet been found.

Trees

(a) Wattle.

South Kavirondo.—A small area was planted during the year. Thinning of plantations was carried out to provide building poles and charcoal. Charcoal burners were persuaded to remove the bark of mature trees and a total of about 40 tons of dried bark was prepared by the end of the year.

Kericho.—Further small plantings continue.

(b) Cinchona.

A nursery was established at Kisii and seed of four varieties—Amani Ledger, Indian Ledger F.2, Josephiana and Hybmid—were obtained from the Director of Cinchona Research, Amani. With the exception of Amani Ledger, germination was satisfactory. During December 3,000 seedlings were transplanted to seed beds and into banana pots. Another 3,500 seedlings were ready for transplanting at the end of the year.

Small permanent plots have been prepared at selected sites in Kericho District, Kisii Highlands, and Kakamega.

(c) Trees (Other than Wattle and Cinchona).

North Kavirondo.—The original tree nurseries were maintained and three new nurseries established in Kakalelwa, S. Kitosh and Itesio.

South Kavirondo.—Forty-nine tree nurseries were maintained during the year. The demand for tree seedlings has greatly increased, but the mortality rate of transplanted seedlings still remains extremely high.

Central Kavirondo.—A tree nursery is maintained at Maseno and the following seedlings were issued during the year.

Eucalypts	..	..	..	..	..	23,000
Cupressus	..	..	..	..	..	3,550

There are approximately 40,000 tree seedlings ready for issue in the Long Rains.

Kericho.—Tree planting has continued on a small scale throughout the year. A block of *Cupressus macrocarpa* has been planted on the Sondu Hills.

Vegetables

An attempt is being made in South Kavirondo to drain a swamp for the production of vegetables for local consumption. In Kericho, encouragement is being given to African producers to supply the Tea Estates with vegetables. Except for the dry period at the beginning of the year the supply of fruit and vegetables to Kisumu has been sufficient, although the quality needs improving.

Seed Issues

The following seed issues were made during the year:—

Maize	.. .. .	20 bags
Mtama	.. .. .	18 "
Wimbi	.. .. .	6 "
Soya Beans	.. .. .	4 "
Beans	.. .. .	5 "
Groundnuts	.. .. .	80 lb.
Peas	.. .. .	90 "
Cassava Cuttings	.. .. .	Several thousands
Sweet Potato Vines	.. .. .	50 bags

A large quantity of vegetable seeds was procured and sold to growers.

Quantities of Produce Marketed in 1946 with Value to Producer

Commodity	Quantity		Value to Producer	
	1945	1946	1945	1946
			£	£
Seed Cotton ..	5,775,207 lb.	6,062,156 lb.	43,605	49,170
Maize ..	640,550 bags	682,068 bags	259,682	292,623
Beans/Cowpeas	3,700 "	3,478 "	5,779	5,430
Choroko ..	1,680 "	1,251 "	2,814	2,188
Potatoes ..	17,293 "	4,500 "	7,133	1,740
Simsim ..	4,530 "	752 "	4,282	762
Groundnuts ..	7,623 "	13,292 "	7,547	14,355
Rice Paddy ..	25,608 "	14,289 "	16,389	9,645
Mtama ..	8,613 "	29,645 "	3,513	12,228
Wimbi ..	23,164 "	44,062 "	18,130	34,930
Wheat ..	1,635 "	2,946 "	1,635	2,946
Coffee ..	182,870 lb.	206,463 lb.	1,000	1,600
Firewood *	—	—	10,000	10,000
Vegetables *	—	—	8,500	8,500
Ghee ..	30,271 tins	34,548 tins	36,375	43,650
Dried Cassava ..	4,397 bags	37,404 bags	1,099	9,351
Eggs ..	5,717,675 eggs	5,060,952 eggs	20,012	19,231
		Totals ..	£447,495	£518,349

* Very approximate estimate.

Crop and Stock Improvement

There has been little opportunity for much in the way of plant trials, but material is available on the farms of the Province for considerable investigational work when staff is available.

A number of preliminary trials on the effects of phosphatic dressings were commenced during the year.

Progress of Mixed Farming

Little progress can be reported until such time as adequate supervision can be given to manuring and other schemes it is proposed to finance with the Agricultural Betterment Funds.

The Kericho Demonstration Small Holding has progressed favourably. The grass paddocks improved under heavy controlled grazing. Star and Kikuyu grass have regenerated very successfully after maize on land which had been cropped for three years.

At Bukura, there are eighteen developed mixed farms varying in size from one and a half acres to twelve acres, and satisfactory progress has been made during the year.

Implements

Ample quantities of light single furrow ploughs are available and it is desirable that some kind of control is exercised over their use in order to avoid damage to the soil and erosion.

Produce Inspection

Reasonable rigid inspection of maize has been maintained. The system of grading maize, which was introduced in October, 1945, and subsequently abandoned, was not again introduced.

It was thought that grading would reduce the amount of maize marketed which is most undesirable when East Africa still requires all the food it can produce.

The following is the summary of bags of produce inspected in Nyanza:—

<i>Produce</i>	<i>N.K.</i>	<i>C.K.</i>	<i>S.K.</i>	<i>Kericho</i>	<i>K/L.</i>	<i>Total</i>
Maize ..	399,157	51,587	123,614	107,374	336	682,068
Mtama ..	7,462	3,011	19,172	—	—	29,645
Simsim ..	401	14	337	—	—	752
Groundnuts..	—	86	13,206	—	—	13,292
Beans ..	—	—	2,905	26	547	3,478
Wimbi ..	3,194	—	38,591	2,053	224	44,062
Choroko ..	—	100	1,151	—	—	1,251
Rice Paddy..	10,574	3,715	—	—	—	14,289
Potatoes ..	71	—	1,497	853	2,079	4,500
Wheat ..	—	—	1,993	953	—	2,946

The following amounts of produce were inspected or re-inspected in Kisumu:—

<i>Produce</i>	<i>N.K.</i>	<i>C.K.</i>	<i>S.K.</i>	<i>Kericho</i>	<i>Total</i>
Maize	7,012	7,833	1,198	1,035	17,078
Mtama	566	80	253	—	899
Wimbi	30	—	524	92	646
Wheat	—	—	12	11	23

The total amounts of produce inspected in Nyanza during five years have been as follows:—

<i>Produce</i>	<i>1942</i>	<i>1943</i>	<i>1944</i>	<i>1945</i>	<i>1946</i>
Maize	544,446	333,847	646,924	640,550	682,068
Mtama	107,543	82,226	72,692	8,613	29,645
Beans/Cowpeas ..	22,179	143	227	3,700	3,478
Simsim	21,546	2,154	681	4,530	752
Choroko	3,279	203	107	1,608	1,251
Wimbi	19,106	9,507	8,592	23,164	44,062
Groundnuts ..	31,176	14,026	9,587	7,623	13,292
Potatoes	—	7,221	18,404	17,293	4,500
Rice Paddy ..	3,942	18,545	26,259	25,608	14,289
Wheat	—	1,558	2,224	1,635	2,946

Marketing

During the year four Marketing Officers were appointed to the Province, one for each of the native districts. It has been difficult to obtain the right type of man and several appointments have had to be terminated and new officers obtained. The Marketing Staff is now up to strength and has taken a great burden off the Agricultural Officers who can now apply their time to true agriculture.

The system of market reports introduced in 1945 is working smoothly and there is now full control of produce from the time it is bought by a produce dealer to the time it is delivered to Control. Attempts are being made by legislation to direct the produce from the producer into the nearest market, thereby reducing the opportunity for traders to practice black marketing.

The continuance of the Jute Control has given Officers much extra work, but such control is essential as long as a shortage of bags exists.

Soil Conservation and Fertility

Progress in a small way has continued throughout the year. No substantial advance can be made until the European Staff is available to plan the complete development of naturally defined areas and until the necessity for a change of the social and land tenure customs of the people is recognized and the necessary action is taken to bring about such changes.

North Kavirondo.—Broad-based terracing continued during the early part of the year in South Kitosh Location. Work was hampered considerably as was the case last year, by careless maintenance of the graders and there were never more than two at work at a time. Good use was made of the Martin Ditcher and this helped to keep work going when the graders were out of action. When the rains broke work was confined to removal of high spots and the grassing of drainage ways. 8.9 miles of terraces were constructed on 80 acres of land.

In the southern locations narrow-based terracing has continued with varying success. The rumour that conservation work was being done to improve the land so that European Soldier-Settlers could take it over has gained ground in spite even of assurances from the Provincial Commissioner. On the onset of the rains attention was concentrated on the stopping of boundary furrows, which nearly always run up and down hill, and the grassing of drainage ways.

There is still a considerable amount of opposition to the construction of narrow-based terraces at three foot vertical intervals. Certain of the Magutu consider that the terraces are too close and demand a greater vertical interval. This argument has always been answered in the same way—that if they wish to cultivate the steep slopes in Maragoli and elsewhere the terracing must be properly done and the vertical interval has got to be three feet.

The correct maintenance of existing terraces is still one of the greatest difficulties, as destruction of terraces during cultivation and weeding continues unabated.

After the harvest of the Long Rains Cereal Crop, an attempt was made to use crop residues in the construction of solid trash lines. This work proceeded slowly owing to some misunderstandings among the indigenous land elders, but once strong Administrative support was obtained, the work proceeded rapidly.

In an endeavour to bring home to the people of North Kavirondo, the dangers of soil erosion, a trip was arranged to Kiambu and Machakos with eleven people of varying political views. The trip was quite a success and the members of the party, with one exception, are now enthusiastic supporters of a conservation programme.

Despite all the propaganda carried out on the reasons for protecting valleys and natural drainage lines there is still a great deal of opposition to any limitation of the individual's control over the land.

River Scouts continue to attempt to prevent clearing and cultivation too near river banks and the subsequent unnecessary damage to land adjoining streams.

Central Kavirondo.—The sum of Sh. 3,000 voted by the Local Native Council was devoted entirely to reconditioning the Wuroya and Uludhi Rivers, up which the Veterinary Department has been clearing against tsetse. The work has been very satisfactory and a good grass cover has been obtained. Unfortunately assistance was not forthcoming from those who will obtain the benefit from this work. Closure of these areas to grazing needs to be made more effective and any grazing allowed must be properly controlled.

As soon as the Long Rains Cereal Crops were reaped, trash lines were laid over a considerable acreage of land in Gem, Alego and Ugenya.

The construction of stone terraces in the Nyahera Hills was carried out prior to planting and instructions have been issued that during weeding any stones disturbed should be placed on the terraces and not left lying in the shambas.

In December a party of Local Native Council Members was taken to Fort Hall to see the methods employed in Soil Conservation and the amount of work carried out. The party returned impressed and keen to make a start in their own district in 1947.

South Kavirondo.—The improvement in the quality of the trash lines mentioned in last year's report has been satisfactory and a very high proportion of shambas in the Kisii Highlands now have adequate trash lines. In the Luo locations the situation is entirely different, but a beginning has been made and although there is visible improvement a great deal needs to be done and continued pressure will be required for a long time to induce the awareness of the necessity for action by the cultivators themselves.

River Scouts continue to demarcate river and stream banks and to attempt to protect a reasonable strip between cultivations and the water side. Cultivation in stream beds, especially among the Kikuyu in East Nyaribari, is strongly discouraged.

Kericho.—Considerable progress has been made during the year on Soil Conservation. Committees have been formed in each location to see that methods adopted are properly carried out, and this they have done with considerable success.

Most shambas have had grass strips left in them on the contour and ploughing is confined to the contour.

Remarkable progress has been made in only eighteen months and this is largely due to the untiring efforts of the District Commissioner, who carried out a propaganda campaign and conducted a party of Kipsigis round the Wakamba Reserve, explaining to them what would happen to their own country if they did not take suitable action.

Controlled Grazing

The people of Belgut in Kericho District have closed the whole of Kenegut ridge of their own volition and a fine cover of grass has been obtained. Other areas of Kericho have also been closed. The visible benefits of closing are so obvious that it is hoped the Kipsigis will be spurred to close even larger areas in 1947.

Elsewhere in the Province much has yet to be done to find a way of convincing stock owners of the value of closing. It is a common practice to close certain areas each year for thatching grass.

Water Supplies

Work on dams in Kericho District was continued during the year. In Bukuria location in South Kavirondo a series of rock weirs were constructed along the water courses. The clearing of ponds in Karachuonyo location was also carried out.

A water regulator was installed by the Public Works Department in the Awach River, Central Kavirondo.

African Agricultural Training at Bukura

Agricultural Training.—Senior Apprentices: 31, of whom seven were dismissed or discharged as unsuitable for training.

Junior Apprentices: 30, of whom one was sent for only 1 year's refresher course. One left as he was mental and one was dismissed.

Teacher Trainees: 3, for one year's agricultural training to fit them for the teaching of agriculture on proper lines in schools. With two teachers this year the work was greatly facilitated: one took the Juniors and one the Seniors, with two evenings a week each for apprentices' evening classes in English and Arithmetic. The divorcing of these two subjects from the main agriculture, animal husbandry and botany subjects has enabled the curriculum to be completed within the two years' course—which had not been possible in previous years—and to extend the course to include such subjects as Agricultural Legislation, Elementary Economics and Soil Conservation.

Graham and Hammond's publication "*Elementary Live Stock and Pasture Management*" is proving invaluable as a text-book in Animal Husbandry, and, with one copy issued to each mixed farm, there is no excuse for improper supervision and feeding of stock on the holdings.

During the year many lessons were revised and brought more up to date.

More expensive and better bound note books were issued this year as the cheap paper-covered exercise books which were formerly issued wear out before they are full and such notes will never form a permanent record for the apprentices, neither will they be capable of referring to such notes in the years to come.

Although many apprentices coming up for training are still standards II and III quite a number have better educational qualifications, whilst four post-primary apprentices are being accepted annually. This gradual raising of the standard of education facilitates the theoretical instruction and will gradually result in a better and more intelligent type of trained Instructor. Even this year under review it has been noticeable that the leavening of higher standard apprentices has

stimulated the more backward apprentices to greater mental effort, and those who were passed out at the end of 1946 were probably the best batch of potential Instructors to leave Bukura. The technical training includes:—

- (a) Rough Farm Carpentry, such as the making of yokes, skeys, sledges, peg-toothed harrows, milking sheds, doors, windows, beds, chairs, and roofing principles, soldering of pots and pans and shaping metal.
- (b) Mason work such as brick making and burning, bricklaying pointing, etc.
- (c) Soil Conservation, laying out of contours at the proper vertical intervals, mensuration, and elementary instruction in the use of the Quick-Set Level.

As a result of such training apprentices are now capable of constructing all farm buildings on their respective holdings and, in fact, carrying out all duties connected with mixed farming. This should save them many a fundi's fees in the years to come.

Health of Pupils.—Bukura is not a healthy place, especially for apprentices coming from Kisii and Kericho. There is much malaria and "Bukura Lumbago". By dusting the swamp on the west boundary with Paris Green and lime, and the flitting of all quarters with D.D.T., the incidence of malaria was moderately reduced this year. The enforcement of a balanced diet to include maize sorghum or wimbi, groundnuts or soya beans, and roots may also have had a bearing on health.

Publications.—(a) "Bukura Native Agricultural School" (E.A. Agricultural Journal of January, 1946). Outlining the work at Bukura, the method of training of apprentices and their social life.

(b) "African Mixed Farming Economics as applied to Bukura" (E.A. Agricultural Journal of October, 1946) dealing with family diet in its relationship to crop rotations and mixed farming on small acreages: the optimum acreage required per average family's food requirements: the size of holding required to give an average family a sufficient annual income.

Publicity.—A Farmers' Day was held on 11th June, and between 500-600 people, chiefs, and elders attended. Visitors in small parties were conducted round the mixed farms, the School, the Spinning and Weaving School, etc., by senior apprentices (who had been previously instructed by lectures and notes in details of publicity). The whole system of mixed farming in vogue here was explained; its actual simplicity, its saving in acreage; its steady improvement of soil fertility, etc.

Visitors were fed the varied and balanced diet of the apprentices and were given soya bean coffee. They appeared to be well impressed with everything and many inquiries were received—especially for Soya bean seed.

Visits.—The following distinguished visitors paid a visit to Bukura during the year:—

The Director of Education, the Director of Women's Training, the Medical Officer of Health, Nyanza, the Hon. Provincial Commissioner. The District Commissioner came in January to investigate the possibilities of starting a Women Teachers' Training School here.

The District Commissioner, South Kavirondo and Tribunal Elders came in February to see mixed farming methods, etc. H.E. The Governor, his Private Secretary, the Hon. Provincial Commissioner, the District Commissioner, the Senior Agricultural Officer on an official visit in June.

Various schools have sent parties of pupils. Several Chiefs and their parties have been shown over Bukura during the year.

Mr. N. Humphrey, Senior Agricultural Officer, paid several visits of an agricultural and anthropological nature.

Captain Kingston Davies of the Military Information Bureau filmed the activities of Bukura last year. It is a pity that still no copy of this film has been obtained by the Department for publicity purposes.

Social Welfare.

Spinning and Weaving.—An average of 34 pupils, including the wives of teacher trainees, attended. With this steady expansion the temporary quarters loaned for this purpose was found to be inadequate, and funds from L.N.C. were made available for the construction of a proper school to accommodate 40 pupils. The building was completed by the end of the year except for doors and windows.

Scouts.—The school maintains a troop of scouts and the apprentices showed a fairly keen interest. The annual Scout Rally was attended at Butere.

Sport.—The football team this year was merely average but keenness was not lacking.

Bukura apprentices acquitted themselves so well at the District athletic sports that six were sent to Kisumu, of whom three were selected to represent the Province and went to Nairobi with the Provincial Team.

Arts and Crafts Exhibition, Kisumu.—Two Certificates of Merit for Spinning and Weaving were obtained at the Provincial Exhibition.

Developments.

(a) *Buildings.*—As previously stated the new spinning and weaving school was built in burnt brick and thatched. Doors and windows only remained to complete the work.

A 3-unit rondavel in burnt brick was completed for the Clerk. Another similar building was completed on No. 2 mixed farm whilst another on No. 16 was started, and by the end of the year the walls were finished.

The implement shed in burnt brick piers was thatched but funds would not permit the completion of the walls with strong maize crib wire—neither was this item available in Kenya. All apprentices' quarters, kitchens and lavatories were whitewashed.

The new school was completed during the first quarter, as far as materials permitted, and instruction was started therein. Paint, guttering, as well as desks for the laboratory section, are still required to complete the job.

(b) *Instructional Farms.*—No. 18 is being developed into a twelve acre mixed farm, having a compound and living quarters, a three-quarters acre timber plot, three acres of arable, three acres of ley and five acres of permanent pasture. This holding is being developed on these lines because many African visitors state that they have much more land than the average six acre mixed farm in operation here and many more cattle than can be accommodated on five or six acre farms. The object will also be to obtain statistical data on profits, man-hours required to cope with this acreage, etc., etc.

Hedges were planted a year ahead for a new instructional farm to be developed this year, and a road of access prepared. A three-quarters acre plot of timber was planted up, and two acres put down to Kikuyu grass ley. This farm will take the place of No. 1 when the latter is absorbed into the Co-operative group of farms.

Plant Pests and Diseases

Locusts.

A number of swarms of flying locusts passed through the Province between April and August, causing only negligible damage. No egg-laying occurred.

Pests and Diseases of Cereals.

Pink Ear-Rot.—In Kericho and North Kavirondo there was a higher incidence of this disease in maize than normal owing to prolonged wet conditions.

Blast Disease of Rice.—This is still serious in certain areas in North Kavirondo.

Blast Disease of Wimbi.—Owing to the wet weather a considerable amount of wimbi had blind heads, due to what appeared to be Blast.

Stalk Borer.—This was slight and local, being confined more or less to Lake Shore areas.

Army Worm.—There was no serious outbreak.

Pests and Diseases of Coffee.

Antestia.—This was bad during July, August, October and November and caused much damage to the South Kavirondo crop, especially in Nyaribari. Baiting with Sodium arsenite-sugar was continued with some success.

Coffee Berry Disease.—This was widespread but did not cause such a heavy loss of crop as last year.

Pests and Diseases of Cotton.

Dysdercus.—Infestations of the late crop in No. 3 area by stainers has caused considerable damage. Under rather unusual rainfall Boll diseases of the early crop have been heavier than usual.

Lygus.—This has done a considerable amount of damage in all areas in the early part of the season.

B. Malvacearum.—Attacks of "blackarm" have been very variable generally following in the path of hailstorms, which have visited all areas.

Potato Disease.

Both Phytopthera and Wilt were negligible.

Datura.—This is on the increase in spite of continual attention and pressure to eradicate this weed.

Mexican Marigold.—Except in thickly populated areas efforts at control have been abandoned as hopeless.

Striga.—Infestation was very severe in parts of Central Kavirondo. In spite of propaganda there was little effort at uprooting.

Agricultural Education and Schools

School gardens and shambas are visited by Agricultural Officers when they can fit such visits into their safari programmes. It has not been possible for sufficient attention to be given to these gardens or to see that advice is properly carried out by the school garden instructors.

Much apathy still exists and attempts are being made to overcome this by supplying refresher courses for teachers at Bukura.

Agricultural Betterment Fund

In Nyanza Province a portion of the difference between the price paid to the grower and the railhead value of maize, is paid into an Agricultural Betterment Fund. This amount depends upon the actual cost of transport from market to railhead. In North and Central Kavirondo, the sum at present allowed for transport is Sh. 1/40 per bag, and in South Kavirondo and Kericho Districts is Sh. 2/10 per bag. The balance after transport has been paid is credited to the Agricultural Betterment Fund. In addition a grade cess of 35 cents is paid into the Betterment Fund.

The total amounts credited for the last four years, in respect of maize are:—

<i>District</i>	<i>1943 Sh.</i>	<i>1944 Sh.</i>	<i>1945 Sh.</i>	<i>1946 Sh.</i>
North Kavirondo..	89,096.24	123,548.47	148,553.06	779,838.09
Central Kavirondo	20,000.11	62,168.40	—	138,299.52
South Kavirondo..	13,358.96	13,814.29	—	221,899.89
Kericho	25,502.90	3,699.70	—	9,976.62

The following debit balances were also incurred:—

<i>District</i>	<i>1945</i>	<i>1946</i>
North Kavirondo	—	—
Central Kavirondo	23,104.02	—
South Kavirondo	12,578.20	—
Kericho	18,323.04	—

For the 1946 sown maize an additional cess of Sh. 3 per bag has been credited to the fund.

The total funds amassed by the end of 1946 are:—

	<i>Sh.</i>
North Kavirondo	1,141,035.86
Central Kavirondo	197,364.01
South Kavirondo	236,494.94
Kericho	20,856.18
Total ..	Sh. 1,595,750.99

Plans are being drawn up for the expenditure of part of these funds in 1947 on rehabilitation of the maize lands, by means of manurial services, grass planting, etc.

Development Teams

Each Agricultural Officer is a member of his District Development Team. These Teams generally sit quarterly at a time suitably related to the Local Native Council Meetings, and put up plans for African settlement and general development. The more important plans under discussion are:—

Kericho.

1. Improvement of Native Stock, Kipsigis.
2. Reconditioning Amala River area and the settlement of the Koiya-Mirigi area.

Kisii.

1. Investigation of the Trans-Mara area of Masai District for future settlement.

These plans are due to be submitted to the Provincial Team of which the Senior Agricultural Officer is a member.

Conclusion

The past year has been satisfactory. Rains have been above average and have continued well into December, thereby ensuring a good Short Rains Crop. The surplus produce available for export outside the Province is likely to be considerably in excess of the original estimates.

The European Staff has been augmented by four Marketing Officers who have relieved the Agricultural Officers of much of the routine marketing work and allowed them to turn their attention to more purely agricultural work.

J. F. WARD,
Acting Senior Agricultural Officer.

APPENDIX

Experimental Work

BUKURA

The following report has been compiled from extracts from the Assistant Agricultural Officer's report on the Bukura experimental work.

Rice Variety Trials.

Alternate rows of five varieties were planted and replicated six times each in two adjacent bunds making twelve replications in all.

The yield figures were submitted to the Statistician for analysis.

The mean yields of the five varieties calculated from the twelve rows are given in order of magnitude.

Bungalo	..	..	..	..	..	65.2 oz.
Maji maji	..	..	..	..	..	54.6 "
Ambarekore	..	..	..	..	..	43.1 "
Sindano	..	..	..	..	..	33.0 "
Mbuyu	..	..	..	..	..	24.6 "

Any two means differing by 9.3 oz. or more were regarded as significant.

Rice Blast.

Conjointly with the above experiment counts of blast were made row by row and variety by variety.

The plots on the whole were not significantly different but the inter-actions between plots and varieties was very significant; both these results were not quite in line with what might be expected. The varieties, judged as a whole, are significantly different among themselves.

The means calculated on twelve observations are given below in order of magnitude ignoring the fact that the inter-action is significant. The factor in this case equals 22.9 also ignoring the significance of the inter-action.

Maji maji	..	..	..	..	..	92.3
Bungalo	..	..	..	..	..	91.8
Sindano	..	..	..	..	..	83.8
Ambarekore	..	..	..	..	..	82.3
Mbuyu	..	..	..	..	..	34.9

The first four varieties were significantly higher than mbuyu.

Rice Blast in Relation to Green Manuring.

Six varieties were each planted in four plots, two of which were green manured and two controls. As the replications were insufficient the results were not sent to the Statistician.

It was, however, interesting to note that Blast tended in most cases to increase with green manuring and that this could not by any means be considered a method of controlling the disease.

Variations from the Mean.

Variety	Green Manure					Control
Senna	..	..	..	+ 39		- 39
Faya	..	..	..	+ 72		- 72
Mbuyu	..	..	..	+ 49		- 49
Bungalo	..	..	..	+ 74		- 74
Sindano	..	..	..	- 49		+ 49
Ambarekore	..	..	..	- 8		+ 8

Sociological Economics in Relation to Land Units.

Over a period of years data has gradually been obtained from the mixed farms concerning this important aspect and an article appeared in the October *Agricultural Journal* on the subject. Only a summary of the findings are therefore given hereunder:—

- (i) The maximum unit of land that can be economically worked by an average family (5.69) under intensive farming conditions is found to be 6 to 7 acres, half of which is under arable and half under ley. To manage this acreage properly the family would have to perform $12\frac{3}{4}$ work-hours daily (i.e. the man full time and wife and children part time).
- (ii) The minimum stock and arable requirements to produce an adequate diet for an average family (2,500 calories) is found to be a 5 acre holding, half ley half arable, carrying two cows one ox and two current year calves.
- (iii) The optimum acreage required to supply a family with a reasonable standard of living (Sh. 400 per annum) is found to be 4 acres of ley, 4 acres of arable, 6 acres of permanent natural pasture, total 14 acres, or alternatively 3 acres of permanent pasture if planted to good grasses, making a total of 11 acres. This ley and pasture would suffice 6 working oxen, 4 cows and progeny (say 3 two-year-olds, 4 yearlings, and 3 calves. the two-year-olds would have to be sold off at each year's end).
- (iv) The ratio of stock to arable on poor soils has been computed from trials at 5 beasts (giving 12 tons FYM per annum) to 3 acres of arable to keep it in good fettle with a manurial rotation of a 3-4 year cycle.

Long Term Phosphatic Trials.

In conjunction with the Senior Agricultural Chemist it was decided to commence some long term field experiments with silicophosphates, to be continued for a period of ten or more years.

The layout of the experiments is in the form of randomized blocks and involves five treatments:—

- (a) No fertilizer.
- (b) Silicophosphates at two levels, 100 and 200 lb. per acre.
- (c) Uganda Rock Phosphate at two levels, 200 and 400 lb. per acre.

The cost of the fertilizer in each of the two levels in (b) and (c) will be the same, i.e. Sh. 5 and Sh. 10 per acre.

The treatments have been replicated six times. The plots are one-fortieth of an acre. Guard rows have been planted outside the block of plots, between the blocks and between the plots. Randomization of the plots has been carried out by each Officer in Charge of the station.

There will be no change in the randomization throughout the whole period of the experiments.

Since the basal idea of the experiments is the application of fertilizers and grass leys to the methods of African Agriculture, as far as possible the succession of crops will be that normally practised in the district. The period of cropping has been decided as four years followed by four years of grass leys. The first crop in each experiment is maize.

At Bukura and Kakamega the following rotation has been decided upon:—

1st Year (1946).—Long Rains Maize; Short Rains Soya Beans.

2nd Year (1947).—Long Rains $\frac{1}{2}$ Mtama and $\frac{1}{2}$ Maize; Short Rains Groundnuts.

3rd Year (1948).—Long Rains $\frac{1}{2}$ Maize and $\frac{1}{2}$ Wimbi; Short Rains Beans.

4th Year (1949).—Long Rains Sweet Potatoes or Cassava; Short Rains Sweet Potatoes or Cassava.

5th–8th Years.—Grass.

The rotation in force at Kisii differs in detail from the above, principally in replacing Mtama with Wheat.

Both Long Rain and Short Rain Crops have received fertilizers. In all cases the application has been done by the method of “placement”. This involves planting all the crops in rows.

A summary of the results of the first crop (Long Rains, 1946) is appended below:—

Average Yields of Maize Straw in lb., per plot

<i>Treatment</i>	<i>Bukura</i>
Control	151.1
S.100 lb.	146.7
S.200 lb.	160.3
U.R.200 lb.	152.5
U.R.400 lb.	131.0

Average Yields of Maize Grain in lb., per plot

<i>Treatment</i>	<i>Kisii</i>	<i>Kakamega</i>	<i>Bukura</i>
Control ..	78.17	75.50	78.83
S.100 lb. ..	90.83	81.66	75.50
S.200 lb. ..	104.33	72.00	87.30
U.R.200 lb. ..	85.00	68.41	79.41
U.R. 400 lb. ..	94.25	82.66	79.75

The size of the individual plots at Kisii are one forty-fourth of an acre and at Kakamega and Bukura one fortieth of an acre.

The rainfall at each station for the period of the crop is shown below:—

<i>Month</i>	<i>Kisii</i>			<i>Kakamega</i>		<i>Bukura</i>	
	<i>No. of days</i>	<i>Inches</i>		<i>No. of days</i>	<i>Inches</i>	<i>No. of days</i>	<i>Inches</i>
March ..	15	6.79		8	2.93	8	5.06
April ..	23	8.19		23	9.74	22	11.95
May ..	25	10.41		23	10.25	23	9.21
June ..	22	6.21		23	10.15	19	10.17
July ..	14	6.30		15	8.67	18	8.05
August ..	18	8.80		24	14.61	23	12.78
September ..	20	4.55		21	10.11	16	8.87
October ..	19	5.28		16	4.87	8	2.10
Total during period ..	156	56.53		153	71.33	137	68.19

Short Term Phosphatic Trials.

On the Department's Farm at Kakamega, randomized block experiments were laid down involving three treatments: no fertilizer, silicophosphates 100 lb. and silicophosphates 200 lb. per acre. Six replications were carried out. A summary of the results is below:—

Average Yields of Maize Grain in lb., per Plot

Control	55.5 lb.
Silicophosphates 100 lb.	50.2 lb.
Silicophosphates 200 lb.	57.2 lb.

The statistic analysis of these experiments have not been completed.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, CENTRAL PROVINCE, 1946

Staff

European.

The following officers were in charge of the Province and districts during the year. In addition Officers of the Dried Vegetable Project worked in South Nyeri District:—

CENTRAL PROVINCE.

Mr. P. C. Chambers, Ag. Senior Agricultural Officer from 1-1-46 to 5-2-46.

Mr. W. Lyne Watt, Senior Agricultural Officer from 5-2-46 to 31-12-46.

MERU DISTRICT.

Mr. J. P. Benson, Asst. Agricultural Officer.

EMBU DISTRICT.

Mr. J. F. Ward, Agricultural Officer from 1-1-46 to 15-6-46.

Mr. G. J. Bernard, Asst. Agricultural Officer from 15-6-46 to 30-10-46.

Mr. G. B. Rattray, Agricultural Officer from 30-10-46 to 31-12-46.

SOUTH NYERI DISTRICT.

Mr. S. V. Subba Rau, Asian Assistant.

FORT HALL DISTRICT.

Mr. T. Hughes Rice, Asst. Agricultural Officer.

KIAMBU DISTRICT.

Mr. G. J. Gollop, Asst. Agricultural Officer.

MACHAKOS DISTRICT.

Mr. M. H. Grieve, Agricultural Officer from 1-1-46 to 8-11-46.

Mr. G. S. Cowley, Agricultural Officer from 8-11-46 to 31-12-46.

Mr. G. Beverly, Asst. Soil Conservation Officer, the whole year.

KITUI DISTRICT.

Mr. L. C. Edwards, Asst. Agricultural Officer.

African.

(i) Government:—

Makerere Assistants	..	..	..	..	1
Clerks	..	..	..	..	10
Agricultural Instructors	..	..	..	..	157
Produce Inspectors	..	..	..	..	7
Teachers	..	..	..	..	—
Apprentices	..	..	..	..	21
Labourers	..	..	..	..	20
Soil Conservation Staff	..	..	..	..	99
Locust Scouts	..	..	..	..	10
River Scouts	..	..	..	..	9
Sundry Employees	..	..	..	..	13

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(ii) L.N.C.:—

Agricultural Instructors	6
Assistant Agricultural Instructors	365
Clerk	1
Labourers	161
Soil Conservation Staff	141
Produce Inspectors	136
Vermin Poisoners	13
Sundry Employees	88
	911
Grand Total ..	1,258

Travelling

The Officers.—European and Asian spent altogether 503 nights on safari and travelled 44,790 miles by car.

General Seasonal Conditions as Affecting Crops and Stock

Food Crops, General.—In all districts the year began badly with failure of finishing rains from the short rains 1945–46. Crops were an almost complete failure in parts of Fort Hall, Kitui and Machakos. Famine conditions prevailed at the beginning of the year in Meru, but were alleviated in February with the harvest of the short rains crop. Machakos and Kitui were as usual worst off. In Meru and Embu the luckier portions of the districts were able to balance the deficits in places where rains fell short.

The long rains crop was also a partial failure. After an excellent beginning in April and May the finishing rains failed to materialize in June, with the result that crops which up to that time had promised well failed to mature. In Kitui the whole of the lower areas harvested practically nothing. In Embu a very promising crop deteriorated to below average. Meru suffered grain shortages. Fort Hall was barely able to harvest sufficient to subsist on. The only district which reported fairly satisfactory Long Rains crops were Kiambu and South Nyeri.

The year ended, however, on a more hopeful note. The short rains which began early, in September, were in all districts satisfactory and in every part of the Province prospects were good at the end of the year. Fears were entertained that the Short Rains would again fail when December was hot and dry, but opportune showers saved the crops. It is now certain that 1947 will not begin with a food shortage as did 1946.

The mist season affecting the higher zones was unusually severe and protracted, and had a detrimental effect in some places on maize and beans. It had some compensations, however, and enabled many people in the lower areas of Fort Hall to plant their Short Rains crop early; they did unusually well as a result.

Grazing was affected through the year by the weather conditions and soil infertility. There were some very bad periods in all areas, but here again prospects were better than for a long time at the end of the year.

Cash Crops.—The principal cash bringers are wattle which with its several products is this year responsible for revenue in excess of £200,000; vegetables, from which the revenue is probably in excess of that recorded, and animal products such as hides and skins, poultry, etc. Arable crops, whether cereals or beans, have been in too short supply to bring in any appreciable cash through legitimate export, though no doubt many black marketeers have filled their pockets.

Maize.—In some districts total or partial crop failures were reported from the Short Rains 1945–46 and Long Rains 1946, particularly Kitui, Machakos and Fort Hall. Kiambu and Meru report a crop well up to average, and in Embu the Ndia Division was able to provide a surplus which made up for shortage elsewhere in the district. A small surplus available from South Nyeri went to the black market. The prospects for Short Rains maize in most districts are fair to good, while maize in the high mist zones is only reported to have suffered in Fort Hall; elsewhere it seems excellent. In Machakos it is hoped that over 70 per cent of the crop will mature but much depends on rain in January, 1947.

Wattle.—The total tonnage of wattle bark exported was 28,701 tons. In the higher areas great difficulty was experienced in drying the bark, owing to rain and mist. This caused delay in starting and deterioration of bark, otherwise the quality was excellent. The main difficulties experienced other than the weather were shortage of trucks on the Railway, and indiscipline on the part of the growers, which was worse than ever before. It is thought this was owing to a combination of high price and the activities of ex-servicemen and other politicians.

A meeting of growers' representatives, manufacturers and Agricultural and Administrative Officers was held at Thika on 6th December, 1946. The problems of the industry were thoroughly thrashed out and it is hoped that the same trouble will not arise next year.

Legumes.—Meru and Embu remain the largest producers of various types of Legumes. The most important are Boston, Rose Coco and Canadian Wonder Beans, Pigeon Peas, Njahi, Cowpeas and Green Gram and Black Gram. Embu reported a decrease in exports of Boston Beans and Green Gram and an increase in Cowpeas, Njahi and Pigeon Peas. In Fort Hall District almost all types of legumes failed during 1946 and no export took place. It is possible there may be a small surplus from the Short Rains crop, which promises better.

From Meru a fair export was achieved, mostly of Njahi and Pigeon Peas. There is a tendency to abandon the planting of Boston Beans in favour of more palatable types which can be used as food. Legumes in Meru suffered to some extent from the weather but a large Njahi crop was harvested in Tigania, where rain came at the right time.

Potatoes.—Kiambu exported 28,748 bags, South Nyeri 7,127, Meru 3,259 and Embu 2,215. This is a marked decrease as compared with last year but some of this is accounted for by the increased difficulty in assessing exports accurately. Potato blight was severe in Kiambu in the latter part of the year, but elsewhere only slight. Drought adversely affected the Long Rains crop in Meru. South Nyeri appears to have been the most favoured district, the crop being heavy, but it largely disappeared after prices fell.

Tobacco.

(a) *Flue Cured.*

		Short Rains Green Leaf			Long Rains Green Leaf		
				Paid to Growers Sh.			Paid to Growers Sh.
	Acres	Pounds			Acres	Pounds	
Embu	}	155	275,729	11,133.30	88	255,536	10,585.73
Fort Hall		80	261,433	11,166.58	80	282,756	11,276.12
Kitui	..						
Total	..	235	537,162	22,299.88	168	538,292	21,861.85

Yields from the Short Rains crop in Kitui were average, but in Fort Hall and Embu Districts, the crop was very light. The Company's Report reads "that the season was one of the most unfavourable ever experienced, that the leaf was small, lifeless and very difficult to cure".

The Long Rains crop in Kitui gave a high yield but of the worst quality ever. In Fort Hall and Embu, however, the quality was higher than for some seasons past and the yield satisfactory.

(b) *Native*.—There is no reason to suppose that there has been any great variation in the amount of this crop grown. The total value in 1946 was estimated at £3,990, which is a conservative estimate. Mwimbi remains the chief producing district.

Coffee.—Arabica.

<i>Area</i>		<i>Total Acres</i>	<i>Total Growers</i>	<i>Sales Shillings</i>
<i>Embu.</i>				
Githungururu ..		22.50	86 }	13,340.00
Ngandori		11.00	32 }	
<i>Meru.</i>				
Chogoria		73.36	274 }	50,660.00
Meru		22.59	82 }	
Totals		129.45	474	Sh. 64,000.00

Total value of crop £3,200

No increase in the number of growers was made either in Embu or Meru, but in Meru extension is planned. New nurseries have been laid down, and the number of seedlings available for planting in 1947 allows for an increase of 120 acres. The Chogoria Co-operative Society plan to build a new factory and to install a power plant in the present factory as great difficulty was experienced in dealing with the crop this year.

The Embu Growers' Co-operative Society had at the end of the year a credit balance of Sh. 2,914.40, more than double that at the beginning of the year.

Quality of coffee from both districts was good, but a certain amount of foxiness lowered the grade in Meru.

Bananas.—Banana export fell off. None was exported from Embu and Fort Hall. Kiambu and South Nyeri continues to export, but figures are only available for South Nyeri. They amount to 635 tons in the year. Value £2,844.

Vegetables, Fruit and Flowers.—The demand for vegetables from military sources fell off and the control buys only a fraction of what it used to. Nevertheless Kiambu estimates that total sales of vegetables were about the same as last year.

Some plums were exported from Fort Hall. Two hundred and nine tons of mangoes were exported from Kitui, and Machakos supplied 1,317 cases of strawberries.

Onions were not exported from Kitui this year owing to drought, but South Nyeri growers raised 177,151 lb. and a good crop is reported from Meru, totalling about 45 tons, making a visible total of 109 tons.

Wheat and Rye.—Wheat growing in Meru fell off considerably in 1946, and there was little surplus. There was less planted, apparently because the returns are

low by comparison with other grain crops, e.g. Maize. A little was grown in Embu District for local consumption and in Fort Hall a big drive to popularize the crop has been made. Ten bags were distributed to selected growers in Machakos. There are a few small plots in South Nyeri. These like those in Fort Hall are doing well. No large scale sales of wheat have been recorded.

Beeswax.—Total reported sales amounted to 1,089 frasilas mostly from Kitui, but with lesser amounts from Meru and Embu. In Meru the people are apparently too lazy to extract the wax for sale.

Pyrethrum.—Kiambu is still the only producer in practical quantities. The Assistant Agricultural Officer reports that the industry is developing on sound lines and that with one exception the standard of farming was high. The standard of picking leaves a good deal to be desired and results in an uneven product. A group drier has been suggested as the most efficient means of dealing with the flowers from farmers who have only small acreages.

There are two farmers growing this crop in Fort Hall District, also on strictly controlled lines.

Stock and Animal Products.—In several districts pasture was so badly affected by the failure of the long rains that cattle were starving and dying. There is no doubt whatever that areas of pasture could be enormously increased if two steps were taken:—

(a) Noxious weeds such as mexican marigold and bracken uprooted.

(b) Deserted *shambas* planted with grass for the fallow period.

As it is, steadily increasing cultivation and weed infestation of the pasture land that remains, place stock keeping in Central Province native reserves in a more precarious position every year.

The main stock and animal products disposed of other than meat of slaughtered beasts, are hides, skins, poultry and eggs. The preparation of the hides and skins still leaves much to be desired though some improvement was recorded this year. The Agricultural Department is to continue to supervise this work in all districts of Central Province except Kitui and Machakos.

With the slackening of control there was some deterioration of quality in poultry and eggs exported from some districts, particularly with eggs. Figures for exports have been almost impossible to obtain from African companies.

Sales of stock and animal products are detailed in Appendix II. There is also a considerable revenue from the sale of milk, of which we have little idea, and which it is almost impossible to record.

Miscellaneous.

Coriander.—Machakos exported 954 bags.

Tamarid.—22.5 tons from Kitui, 16,000 lb. from Meru.

Castor Seed.—29.2 tons from Kitui.

Crop Position and Improvement

It is not possible to record any substantial improvements in food crops grown in the Province. Food shortage again enabled any sort of grain or legume to find a ready sale, and planting material was very often mixed as there was no other available.

The seed issues detailed below reflect such progress as has been made. Grass seed issues, and fruit and other trees are really the most important from the agricultural point of view as being indicative of a trend towards improved use

of the land and methods of farming. The majority of other seed issues amount to a form of famine relief and were mostly given out in Machakos District. Here 1,916 bags of Bulrush millet, 1,508 bags of Boston beans and 501½ bags of wimbi were issued.

Cereals.

Bulrush Millet	..	..	..	..	..	1,917 bags
Sorghum	..	..	..	..	..	1 bag
Wimbi	..	..	..	..	..	501½ bags
Wheat	..	..	..	..	..	33 "

Legumes.

Boston Beans	..	..	..	..	..	1,508 "
Rose Coco and Canadian Wonder	..	..	..	..	..	3 "
Cowpea	..	..	..	..	..	3 "
Green Gram	..	..	..	..	..	6 "
Peas	..	..	..	..	..	25 "

Grass Seed, etc.

Rhodes Grass	..	..	..	..	..	24 "
Lucerne Seed	..	..	..	..	..	40 lb.

Fruit trees included the following varieties: oranges, lemons, grapefruit, lime, pawpaw, avocado pears, guavas, loquats, mangoes, plums. The greatest numbers were citrus and pawpaw. Many hundreds of packets of vegetable seeds were also issued.

Progress in Mixed Farming

Nowhere on the reserve is there yet a stable farming system based on grass and manure. There are, however, two encouraging features. The first is an increasing realization of the value of manure. In Kiambu, although the system of manure supply in use last year had to be abandoned through tardy payments, it has caused many people to obtain their own supplies or to make it themselves. In Fort Hall many new cattle sheds are being erected every month, and it has been impossible to obtain even a few tins of manure for tree nurseries at 20 cents a tin.

Even more heartening is the news that at last the people of Machakos are beginning to utilize the manure which they have hitherto left lying around their *bomas*. The Agricultural Officer, Machakos writes:—

“During the year, there has been a most welcome change in outlook towards the use of *boma* manure, especially in the Northern locations where ample stocks of manure are available in the plains towards Komo rock, and the practice of using manure in Kangundo and Matungulu locations is now almost general in all fields.”

Most of the manuring is done in Kangundo and Matungulu locations. In the other areas the sparseness of the grazing and the need to move stock elsewhere results in negligible amounts of manure being made.

The second encouraging feature is an increasing number of good individual efforts in paddocking, and the intelligent use of beasts and grass. Of one farmer in particular the Assistant Agricultural Officer, Kiambu writes:—

“J. N. Kamau has a small farm split into three paddocks with a small food *shamba*. The grazing probably comprises five acres and on this he carries four grade cows, one grade bull, and two head of young stock.

Calves are kept separate and get at least one gallon of whole milk a day. When asked when he was going to buy some more cows he indignantly pointed out that were he to do so there would not be enough grass for them or the ones he already had.”

This is a refreshing change from most of the Kiambu farmers, who habitually overstock their land and ruin any good work they may have done.

There are many cattle kraals in South Nyeri division but little effective use is made of the manure. In Embu the situation still leaves much to be desired and Meru has nothing to report beyond further progress in the clearing of bracken and its replacement by grass. This last process is also going on as more and more land comes under cultivation in the high zones of Fort Hall and South Nyeri. It is now becoming very important to establish a sound stable system of farming depending upon grass pastures and the careful conservation and use of manure.

Soil Erosion and Soil Fertility

	1945	1946
Miles terraced	6,922 miles	13,131 miles
Area terraced	—	39,429 acres
Live wash stops (Meru only) ..	152 miles	12 miles
Grassed drainage ways	1,299	6,121
Area grass planted	13,700 acres	4,688 acres
Compost pits and <i>bomas</i> in use ..	13,805	28,389
Strip cropping	3,838 miles	3,459 miles
Eroded land closed to grazing ..	35,942 acres	*83,294

Terracing.—In 1946 a further substantial increase in terracing was achieved. The main increases come from Fort Hall, Kiambu and Machakos. Embu showed a large decrease in mileage terraced, also Kitui. South Nyeri remains a most backward district in this respect.

The totals from Fort Hall are now reaching astronomical proportions, 6,916 miles having been done this year. The Assistant Agricultural Officer writes:—

“Figures of acreages cannot really be regarded any longer as entirely reliable. It has now reached the stage when more European staff are quite essential to keep an accurate record of areas and acreages done. One officer cannot hope to accomplish this and keep the people from flagging. The standard of terracing carried out has improved immensely during 1946. Spacing and size of terraces have improved everywhere. Flattening off of terrace banks is now standard practice and all areas of terracing have a large cut off drain on the top side. Terracing generally has been well maintained by the Muhiriga and has stood up very well indeed to the heavy spells of rain during the year. Reclamation areas which have been terraced, grassed and closed are now mercifully covered over, thanks to a favourable year of rainfall, and many of the areas done earlier have been reopened to controlled grazing.”

In brief, the matter of soil control in Fort Hall District is now well in hand though of course much remains to be done. Kiambu reports that terracing has become general throughout the district and that the right-holders appear to have accepted maintenance as part of their routine. In Machakos the very satisfactory increase of 916 miles which has been achieved this year is attributed to a large increase in the number of paid levellers employed. Most of the decrease from the Embu District is accounted for by the closure of much work in the Dried Vegetable Project area, and the low mileage completed in Meru District is to a large extent due to the short period available between crop harvests for terracing work, and the lack of intelligent levelling staff. In Kitui the people have been for the most part antagonistic to terracing work. South Nyeri remains one of the

* Figure not complete.

most backward districts. Here the Muhiriga system is in force, but it is not being effectively applied and the amount of terracing done is very much below that which ought to be done by the communal labour available under the system. It is quite clear that until the chiefs and elders co-operate and show greater energy better progress in South Nyeri District will be very slow.

It is good to be able to observe that in almost all districts there is improvement in the standard of terraces constructed, and also in their maintenance.

Grass Planting.—Encouraging progress is reported from Fort Hall, Kiambu and Meru. In Embu it is still very disappointing and the same is true of South Nyeri. In Meru the favourable weather conditions have given a considerable fillip to grass planting. Failure in previous seasons had discouraged the people.

Grass drainage ways are completed in proportion to the amount of terracing done. Where terracing is done piece meal, however, the drainage ways are often not completed until a large area of terracing has been dug. There is still a tendency for people to use these ways too much as footpaths. On a hillside which is almost completely terraced this is not surprising, but on steep slopes it must be checked or gullies are formed.

Strip Cropping.—Little progress can be reported in this connexion. In Fort Hall, where the work is most advanced, the system has come in for much political opposition. The Kapingazi project in Embu is fast failing owing to lack of co-operation from the landowners, and no money has been spent on it other than the employment of a guard. The first signs of strip cropping are now showing in Machakos, where large areas under cultivation with single crops between terraces, may sometimes be seen instead of the usual mixed cropping.

Paid Labour Gangs.—Where these have been employed work has proceeded satisfactorily. The work in the areas near the Fort Hall-Thika Road has attracted much attention from passing motorists. The local Africans co-operate with the gangs here doing the straight forward terracing while the gangs deal with the more difficult gully work. In Embu work has continued satisfactorily on the Gitigi Hills. Grass has been planted extensively, terraces enlarged, and the area under complete control of grazing.

Tree Planting and Protection.—The most useful work in protection was done in Meru, where the people have sound ideas on the subject. Considerable interest was shown in Fort Hall also. In Meru a number of spring heads were protected by the planting of trees and grass, and concern has also been felt at the increase of pit saws. The L.N.C. passed a resolution to the effect that timber trees might not be cut without the permission of the Mwiriga and further that for every tree cut five should be planted in its place.

There is still a demand for trees from our nurseries and three new nurseries have been opened in Fort Hall. The sites for these were infertile, and the demand for manure locally has been such that it has been necessary to send manure by lorry from Fort Hall seed farm to the nurseries.

Swamps.—As more and more land becomes exhausted more and more people want to open up swamps for cultivation. This has been disallowed by the Fort Hall L.N.C. on the grounds of water conservation. A number of swamps were cleared of sugar cane in Meru District.

Dams and Water Supplies.—Three dams in the Kitui Yatta B2 were damaged by storms in April, repaired in June and July and refilled in the short rains without mishap. The dam at Wakabali burst, probably owing to termite damage. This dam was constructed in 1935. Two new bore holes were made in Kitui providing 800 and 200 gallons per hour.

In Fort Hall there was a demand for two dams, but after agreement had been reached, strong opposition was raised and the project had to be shelved. Another proposed dam, in the Sabasaba area, had to be abandoned for similar reasons after all preparations had been made. Opposition in both cases was of a political nature.

Areas Closed to Grazing.—In Machakos a total of 63,117 acres was closed to grazing. Three thousand, three hundred and sixty five acres of worn out grazing were replanted, almost entirely with *Cynodon* sp. Both planted grass and planted trees have, however, a hard task to survive in the worn out lands of Machakos. The Agricultural Officer remarks:—

“Closing of eroded over-grazed land can only be regarded as the first step towards establishing a good grass cover and much work must be done to find the most suitable grasses to plant in different areas. The natural regeneration of grass on closed areas is mostly poor annuals of little use for grazing.”

The Chiefs appear to have closed large areas on their own initiative, and the danger is that stock will return to these areas before a good soil cover has been produced. Their praiseworthy action may thus end in no good result, and it cannot be too strongly stressed that adequate technical and supervisory European staff is required in Machakos for the proper study of such problems.

The Agricultural Officer, Machakos writes:—

“Improvement to worn out grazing land presents a real and pressing problem. Campaigns to plant grass are usually frustrated on the valid grounds of having urgent personal crop planting to achieve while the planting conditions are favourable. Campaigns for terrace maintenance are usually met with a number of excuses, but the one most widely used recently is grounds of inability on account of hunger. The appearance of the people does not support the excuse. Intentional avoidance of work is the probable reason

Resting of grazing lands is giving disappointing results. Masai location now rested for three growing seasons shows us a sparse cover of inferior grasses whose only possible value is one of preventing soil erosion. The quality is such that the grazing value is so low as to be of no account and it is difficult to believe that it will be of any assistance in raising the humus content of the soil, improving structure or contributing in any of the other valuable ways attributed to a good grass cover and vitally necessary in these conditions. It is to be hoped that a direct plan of establishing grass on rested worn out land will be instituted and yield better results than are achieved by simply leaving it in a fallow condition to re-establish on its own accord.”

Famine Prevention

Famine relief on a considerable scale was again necessary in Machakos and Kitui. In Meru it was necessary to import 2,500 bags of meal to feed Tharaka and a small issue of famine relief was made in Kiambu, but little of it was sold. Embu, Fort Hall and South Nyeri required no relief. Considerable losses of planting material of cassava occurred in Machakos and Kitui. This is all the more regrettable as in many cases it is avoidable and entirely due to laziness and apathy. Six cassava bulking plots are maintained in Machakos District but shortage of planting material has restricted the extension of similar plots in Kitui. In spite of the ravages of pig, porcupine and drought, if these dry areas are to have a reserve of famine prevention crops the further extension of these plots is essential.

In the higher wetter areas of Meru good reserves of yams and bananas are available but in the lower areas sweet potatoes and cassava have often failed owing to drought. In spite of this the district, with the exception of Tharaka, remained self supporting.

In Fort Hall bananas are the great stand-by in times of food shortage and this crop definitely averted what would have been very serious famine in the first half of 1946. The closing of swamps has tended to reduce the planting of Colocasia, sweet potatoes, etc. Growers are still rather scared of the recrudescence of mealy bug and for this reason yams are increasing slowly.

Embu planted 2,930 acres of sweet potatoes and 2,506 acres of cassava. South Nyeri reports considerable planting of sweet potatoes and yams.

Crop Investigational Work

A summary of the work done at the various stations is given below:—

Meru.—Coffee Variety Trials:—

Variety	Mulched		Unmulched	
	Cherry lb.	Buni lb.	Cherry lb.	Buni lb.
Harrar	160	51	32	14
Bourbon	168	47	51	14
Kenya Selected	71	33	11	4
Kents T.T.	249	87	64	21
Blue Mountain	427	159	39	15
Geisha	224	65	33	11
Kents Ceylon	341	113	36	12

Kents T.T. did not take first place this year owing to the change over to new growth in the multiple stem system not coinciding with the other trees. It remains the highest, average yielder over the last six years.

Other trials attempted at Meru failed through drought.

Kitui.—Silicophosphate trials were laid down at Ithokwe and Ikutha but failed through drought and locusts respectively, after giving no preliminary usual indication between treated and untreated plots.

Fort Hall.—Silicophosphate trials on the Long Rains failed owing to drought.

The following yam varieties were given up as unsuitable:—

Hendeni No. 3, Kashula Bukoba, Angalalia, Uzi Amani, Hendeni No. 1.

Experimental plots of the following grasses and fodders were maintained:—

Rhodes, *Bromus marginatus*, *Melinis minutiflora*, *Paspalum dilatatum*, *Beckeropsis* sp., *Digitaria swazilandensis*, Edible Canna and Lucerne. Of these *Bromus* and *Beckeropsis* do not thrive at Fort Hall, though they would do well at higher altitudes.

Embu.

(a) Cassava variety, yield, palatability and resistance to mosaic trials.

(b) Rotational grazing experiment.

(c) Grasses for washstops.

(d) Silicophosphate trials.

(e) Grass burning experiments.

(f) Grass plots in bracken areas.

South Nyeri.—A new potato variety—914, is being bulked on the L.N.C. seed farm. Safflower is being tried as a possible oil seed. *Bromus marginatus* and Rhodes grass are also being bulked, and there are observation plots of many other grass species.

Silicophosphate trials are being carried out on sorghum, maize, beans, peas and potatoes. There is no marked difference between any of the plots.

Machakos.—A variety trial of sorghums and observation on some hybrid maize plants.

Produce Inspection

There was again little produce to be inspected, owing to the prohibition of exports from most districts. The Inspectors were largely engaged in trying to check illegal trade. In Fort Hall they were unable to prevent the sale of some produce which had not paid inspection fees.

Quality of wattle bark was generally good in the first season. In the Short Rains season, however, quality deteriorated owing to the wet and a rush to sell large quantities on the part of the growers.

There was deterioration in the quality of eggs and poultry exported owing to the slackening of control over these products.

Marketing

The value of sales estimated for the whole Province was approximately £712,890. Details are given in Appendix I.

Average prices paid to the producers were as below:—

- Maize: Sh. 9/60 per bag.
- Boston beans: Sh. 23 per bag.
- Rose Coco beans: Sh. 18 per bag.
- Canadian Wonder beans: Sh. 17 per bag.
- Bengal gram: Sh. 90 per bag.
- Green gram: Sh. 70 per bag.
- Black gram: Sh. 90 per bag.
- Pigeon pea: Sh. 55 per bag.
- Wheat: Sh. 21/30 per bag.
- Potatoes: Sh. 10 to Sh. 12 per bag of 180 lb.
- Field peas: Sh. 23 per bag.
- Dolichos bean: Sh. 60 per bag.
- Bulrush millet: Sh. 18 per bag.
- Ghee: Sh. 43 per tin.
- Beeswax: Sh. 54 per frasila.
- Wattle bark (Thika): Sh. 4/90 and Sh. 5/80 per 100 lb. or Sh. 109/76 and Sh. 129/92 per ton.
- Hides (shade dried): Sh. 21/60 per frasila.
- Skins: Sh. 36 per score.

There has been a large increase in demand for trading plots, and a good deal of Officers' time is taken up with this. In some cases the proportion of time spent on marketing matters is far too great, particularly in South Nyeri where the Asian Assistant did little else. This is particularly absurd when it is realized that much of this work has little or nothing to do with the disposal of agricultural products. When an officer in charge of a district is unable to attend to his agricultural work because he has to spend all his time allocating plots for hotels and carpenters' shops the position is absurd. The sooner the agricultural staff can be released from this work the better will be the agricultural progress made.

Agricultural Education

Agricultural School, Embu.—Of 23 Apprentices who were in attendance at the beginning of the year two resigned in April, one deserted in June and one completed the course in May. Twelve completed their course at the end of the year.

The teaching is now in the hands of African Agricultural Assistant Samuel Mbugua. He took over in August, two Instructors having resigned earlier in the year.

The Agricultural School buildings have been enlarged during the year to accommodate pupils from Fort Hall and Machakos.

Education Department and Mission Schools.—Advice has been given by Instructors and Agricultural Officers when possible. Some progress has been made in Meru, but little in Fort Hall District where the agricultural education standard is described as quite deplorable and needs drastic attention.

A refresher course for Mission teachers was held at Fort Hall in May. Twenty six teachers attended.

Native Agricultural Education.—The following parties visited Fort Hall district:—

(a) 22nd and 23rd January, a party of Tanganyika Chiefs.

(b) 27th to 29th June, a party of Kitui Chiefs.

(c) 7th to 9th October, a party of Embu Chiefs.

(d) 9th to 11th December, a party of Central Kavirondo L.N.C. members and Machakos Chiefs.

These parties were all much impressed with what they saw in the district.

In Kiambu Muthubi's subsidized small holding is an example to the surrounding country, and is proving a useful method of agricultural propaganda. A number of prominent persons, chiefs and elders from North Kavirondo and from Kilifi, and members of the Colonial Film Unit visited this smallholding during the year.

Vermin, Pests and Diseases

(a) Vermin.

Destruction of various animals attacking farm crops and stock continues. The largest number of these are ground squirrels, porcupine, buck and wild pig. Hyenas and jackals are also troublesome. The Game Control Officer at Meru destroyed a number of elephant, buffalo, rhinoceros and several lions.

(b) Insect Pests.

Locusts.—Invasions of locusts have been promptly dealt with where they occurred. In Kitui and Fort Hall gammexane bait was used with excellent results. Damage was not widespread anywhere in the Province.

Mealy Bug.—Small outbreaks occurred in most districts but have all yielded to the ordinary parasitic control.

No progress is made, in spite of increased efforts, in inducing cultivators to root up old pigeon pea plants. The root mealy bug and therefore Fusarium wilt, have not decreased in the areas where they occur.

Stalk Borer.—Reported from various places. It does not seem to have been severe except in Embu.

(c) Plant Diseases.

Fusarium Wilt.—Shows no signs of decreasing where it occurs and in Fort Hall it is reported on the increase as the fertility of the land goes down. Control is impossible unless the cultivators will do it themselves.

Potato Blight.—Was not noted as severe except in Kiambu where there was a heavy attack at the end of the Short Rains. This was, however, largely on volunteer potatoes cultivated in a slovenly way.

Mosaic Disease.—Incidence remains high, and yields are adversely affected.

Maize Streak.—No serious damage is reported, though yields were depressed in South Nyeri, particularly in more infertile districts.

(d) Noxious Weeds.

Uprooting of *Datura stramonium* continues fairly satisfactorily. In Meru also great progress has been made with the elimination of bracken and Mexican Marigold and consequent increase of pasture. Good work on Mexican Marigold has also been done in Fort Hall and Embu districts. In South Nyeri the incidence

of Mexican Marigold has assumed the proportions of a major menace. Up to 40 per cent of pasture land is infested with it, and in almost all fallow land it occurs as a hundred per cent pure stand. It is estimated that in South Nyeri District alone 10–12,000 acres, at least, of pasture land (not counting fallow land as possible pasture) are lost. If fallow land were included as pasture this figure would be about 85,000 acres. It is hardly necessary to emphasize the enormous benefit this amount of extra pasture would be to the stock and the people. It will be many years before we can hope to have fallow land planted to grass, but the first figure could be attained in a few days work by the people themselves. Yet thousands daily stand idle and watch their cattle trying to pick up a livelihood in the reduced acreage of pasture that remains free of Mexican Marigold. It should be emphasized that planted pastures most certainly tend to eradicate Mexican Marigold provided proper grassland management is exercised.

Annual Expenditure and Revenue—See Appendix No. 2

General Remarks

Progress.—Under this heading, for 1945, mention was made of a better understanding and progress in Meru. By the excellent administration, the advance made could be considered to be better than was anticipated, and most substantial headway has been attained which would appear to be of a lasting nature. The miles of terracing may not take a high place, but so much has happened in these twelve months that one can be satisfied, and hopeful of further accomplishments in 1947.

Kitui on the other hand, with so much antagonism against soil control, and the loss of several months' work while locusts were being dealt with, caused agriculture to stand still.

Under this heading, many branches of our work could be dealt with, the most spectacular being the great area of Fort Hall land which has been brought into a safe condition through terracing. As practically the whole of this has been done voluntarily, it says much for the Officers who organized the willing workers.

Kiambu has again taken top place in the use of manure, and to one who has been preaching the gospel of the need for manure, it becomes difficult to believe that the tribesmen could at last have been persuaded to such a practical realization of its importance in farming. Many now refuse to waste their manure on unterraced land and are making heavy demands on the time of our terracing surveyors.

Political Agitation has greatly hindered our efforts to the people. These seekers of money and notoriety are not necessarily interested in the people or the tribal land, but simply prey on the simple lazy people for what they can get out of any new effort on the part of Government to help them. This sort of thing becomes most irksome to those who are giving of their best in an endeavour to improve the wellbeing of the people. South Nyeri District has suffered more from this nonsense than any other district.

Soil Fertility continues to decline in most places. Tribal beliefs were given as the chief reason for failure to manure land, but now one can safely say that laziness is the hindering factor. The great advance in the use of manure in Kiambu can be credited to the high percentage of men who are working on the land, and it is considered unlikely that any real advance will be made elsewhere till the men take a more practical interest in their holdings.

The Marketing of surplus food crops has become a most irregular performance. Prices offered by black marketers have been tempting, and one finds few people who are likely to go back to proper selling for some time to come.

W. LYNE WATT,

Senior Agricultural Officer, Central Province.

APPENDIX I

Rainfall

	1945	1946
	Inches	Inches
Meru Township	31.19	54.13
Embu Township	27.59	48.34
Nyeri Township	34.48	25.61
Fort Hall Township	35.43	47.13
Kiambu Township	37.95	37.25
Machakos Township	19.09	27.13
Kitui Township	37.63	37.92

APPENDIX II

Statement of Revenue from Produce

PRODUCE	SALES 1945		SALES 1946	
		£		£
Maize and Maize Meal ..	3,077 bags	1,511	993 bags	478
Millet	7,431 "	7,452	1,816 "	1,795
Wheat	4,743 "	5,052	1,064 "	1,133
Legumes	39,663 "	84,014	38,665 "	108,182
Potatoes	93,872 "	52,014	41,349 "	43,724
Pyrethrum	—	3,000	—	2,500
Tobacco (Flue Cured, Green)	1,571,896 lb.	3,174	1,075,454 lb.	2,208
Tobacco (Native Cured) (Approx.)	266,000 "	3,990	169,178 "	3,583
Coffee Parchment	45,667 "	2,103	48,714 "	1,995
Coffee Mbuni	4,499 "	789	70,904 "	1,205
Vegetable, Fruit, Flowers, (Approx.)	—	116,500	—	118,920
Bananas	3,800 tons	17,076	635 tons	2,844
Onions	6,659 fras.	1,197	7,739 fras.	2,155
Beeswax	500 "	1,170	1,089 "	4,460
Wattle Bark	22,050 tons	102,246	28,701 tons	153,530
Fuel and Poles (Approx.)	98,800 tons	24,700	100,000 "	25,000
Charcoal (Approx.)	282,694 bags	23,265	300,000 bags	25,000
Hides	19,397 fras.	20,347	22,702 fras.	34,291
Skins	13,277 scores	16,115	16,084 scores	28,481
Ghee	190 tins	475	47 tins	101
Pigs	1,326 head	3,459	690 head	1,593
Poultry	215,059 "	25,729	209,121 "	22,385
Eggs	9,290,743 eggs	58,004	7,231,794 eggs	35,493
Miscellaneous (Approx.)	—	5,400	—	5,000
Dried Vegetable Project	—	71,506	—	37,512
TOTAL VALUE ..		£ 630,298		£ 663,568

Stock Sales.

Cattle—estimated at Sh. 50 per head	8,862	£22,155
Sheep and Goats estimated at Sh. 10 per head	54,334	£27,167
Total ..		£712,890

APPENDIX III

Central Province—Annual Report

Expenditure and Revenue, 1946

<i>Agricultural Department</i>	<i>Expenditure</i>			<i>Revenue</i>		
	£	s.	cts.	£	s.	cts.
Meru	1,070	12	00	17	13	80
Embu	1,487	4	85	17	6	10
Nyeri	1,383	16	37	2	0	0
Fort Hall	1,948	18	30	10	19	25
Kiambu	1,539	17	69	—		
Machakos	* 5,385	12	91	—		
Kitui	245	8	87	—		
	£13,061	10	99	£47	19	15

<i>Local Native Councils</i>	<i>Expenditure</i>			<i>Revenue</i>		
	£	s.	cts.	£	s.	cts.
Meru	2,422	9	63	146	9	26
Embu	2,413	6	46	191	12	15
Nyeri	1,994	0	0	812	7	13
Fort Hall	2,537	13	67	967	14	71
Kiambu	646	17	36	810	11	20
Machakos	2,428	15	59	397	11	24
Kitui	828	4	68	78	7	84
	£13,271	7	39	£3,404	13	53

* £3,966 16 96 Administration Extraordinary.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, COAST PROVINCE, 1946

Staff

European.

Mr. M. H. Grieve was posted to Mombasa and took over from Mr. N. D. Spranger who proceeded on leave pending retirement on 2nd December, 1946.

KIBARANI.

Mr. M. D. Graham, A.E.O.: 1-1-46 to 5-2-46.

Mr. A. Storrar, A.O.: 5-2-46 to 28-8-46.

Mr. W. J. Corkhill, A.A.O.: 28-8-46 to 31-12-46.

VOI.

Mr. R. O. Williams, A.O.: 1-1-46 to 4-9-46.

Mr. P. A. Jones, A.O.: 4-9-46 to 31-12-46.

DIGO.

Mr. C. D. Knight, S.A.A.O.: 1-1-46 to 6-9-46.

No Officer: 6-9-46 to 31-12-46.

TAVETA.

Mr. E. Bellis, A.O.: 1-1-46 to 31-12-46.

Asian.

Mr. W. R. Sethi, Indian Agricultural Assistant, returned from leave on 22nd March, 1946, and was posted to Gede, where he remained until the end of the year.

African.

Mr. David Mbotela, African Agricultural Assistant was transferred from Kibarani to Taveta on 8th November, 1946.

African Agricultural Instructors were posted as follows:—

				Dept.			
District				of Agric.	L.N.C's.	C.B.F.	Total
Mombasa	..	..	..	1	—	—	1
Taveta	..	..	..	2	1	—	3
Voi	..	..	..	9	1	—	10
Digo	..	..	..	9	1	—	10
Kilifi	..	..	..	12	—	—	12
Malindi	..	..	..	9	—	—	9
Gede	..	..	..	6	—	—	6
Tana River	..	..	..	—	5	—	5
Lamu	..	..	..	1	—	2	3
				—	—	—	—
				49	8	2	59
				—	—	—	—

In addition to the above, 10 River Scouts were employed during the year.

Labour was employed on Seed Farms, Experimental Plots and Soil Conservation work. The Department paying for the Experimental side and the Local Native Councils covering the rest.

Seasonal Conditions

The general failure of the Short Rains 1945-46 throughout the Province and the delay in the onset of Long Rains made the first four or five months of the year one of the driest period on record. Even at Wundanyi on top of the Teita

Hills only 1.03 inches of rain were recorded for the first quarter of the year; while in the Coastal belt no really effective rain fell until May. The Long Rains were variable and generally about average although starting late and finishing early. In some parts they were more satisfactory on the coast than they were inland.

A remarkable feature of the rainfall this year was the exceedingly heavy rainfall throughout the coast towards the end of September. Fifteen inches of rain were recorded in two days at Kilifi, while Gede had nearly 20 inches during that period. This early and unusual rain in September was taken full advantage of and being followed up by a good Short Rains season especially in the more inland areas, the year closed in a fairly promising manner.

Rainfall		1946	1945	1944
		Inches	Inches	Inches
Wundanyi (Teita)	..	51.59	39.31	55.56
Kibarani (Kilifi)	..	43.12	38.62	44.36
Msambweni (Digo)	..	63.05	58.69	66.16
Lamu	.. ..	33.39	40.56	38.44

Food Crops

Voi District.

(a) *Maize*.—Like most other tribes maize is the most popular food in this district. The almost complete failure of the Short Rains 1945–46 crop and the delay in the Long Rains caused considerable hardship so that imports of meal had to be made. The people reacted to this shortage by an excessive planting of maize during the Short Rains, which being favourable gave the district one of the most promising maize crops it has ever had at the end of the year. Little Yellow Durum maize is planted in the hills, although for several years the aim has been to replace the white types with the more drought resistant varieties.

(b) *Legumes*.—Canadian Wonder Beans generally inter-planted with maize were only fair at the beginning of the year, but in spite of excessive rain in November a good Short Rains crop was assured. Cowpeas yielded well, but Pigeon Peas were disappointing.

Digo District.

(a) *Maize*.—Except in the more fertile areas especially in the Kikoneni-Mrima country the crop was poor and had it not been for the extensive production of Cassava food shortage might have become serious.

(b) *Legumes*.—There is a remarkable lack of legume production in most parts which is probably to some extent responsible, nutritionally, for the Wa-Digo lack of resistance to disease. Efforts are being made to redress this deficiency.

(c) *Cassava*.—The 1945 planting campaign was so successful that this is now one of the main foods used in the district. In some areas there has been an undesirable excessive planting at the expense of other crops.

Kilifi-Malindi District.

(a) *Maize*.—Yellow Durum is proving a very useful variety in the district and fair to average crops were harvested.

(b) *Legumes*.—Cowpeas were in good demand and yields above average were obtained. The Giriama are far more interested in pulse production than their southern neighbours the Wa-Digo.

(c) *Millet*s.—Only small acreages were grown. It is not generally a popular crop on the coast.

Other crops such as Cassava, Bananas and Sweet Potatoes are grown in most areas and form a very valuable adjunct to the native diet.

Lamu-Tana River District.

Food supplies generally were quite plentiful especially along the river. Cow-peas were planted extensively and good crops were harvested as a rule.

The rice crop on the lower Tana was seriously affected by excessive flooding towards the end of the year and although some harvesting was completed in time much of the crop was completely inundated.

General.—The May Rains crops were generally below normal, but the Short Rains crops assisted by the early rain in September were more satisfactory.

In many ways the year was typical in that the Long Rains were adequate for crops on the coast, but poor inland, while the Short Rains were the reverse.

There have been periods of local food shortage which cannot be described as famine, and supplies of mixed meal were made available when and where necessary.

Economic Crops

Vegetables.—The Teita Hills in the Voi District have for some years and particularly during the war become an important source of supply for Mombasa. It is considered to be the main economic crop in this area and has received considerable attention in its development.

The Teita Vegetable Company who are a group of Wa-Teita Vegetable Producers living in the Hills were registered to become the "Teita Vegetable Co-operative Society Limited". Their production shows a wide range of varieties, some 22 different kinds were sold during 1946, as the following will show. It will be observed, however, that the proportion of Cabbage is unduly high and steps are being taken to remedy this.

<i>Produce</i>	<i>lb.</i>	<i>Percentage</i>
Cabbage	237,792	42.00
Lettuce	54,794	9.70
Beans	41,156	7.30
Turnip	38,684	6.82
Marrow	36,187	6.40
Carrots	32,288	5.70
Peas	17,864	3.16
Tomatoes	17,410	3.08
Beetroot	15,550	2.70
Cucumber	14,149	2.50
Pumpkin	12,490	2.20
Leeks	12,390	2.18
Spinach	10,239	1.80
Broad Beans	6,557	1.16
Squash	6,097	1.08
Spring Onions	3,167	.56
Onions	2,628	.48
Celery	2,162	.38
Radishes	1,546	.28
Parsnips	1,455	.26
Green Chillies	929	.16
Cauliflower	591	.10
Totals ..	566,125	100 %

1946 has been an unsatisfactory year for the industry as the following returns demonstrate, and a careful and detailed survey of the position was made by a special Officer at the end of the year. As a result of this investigation plans have been made with a view to helping the industry on a sounder and more economic basis.

1944	1945	1946
3,075,157 lb.	1,988,052 lb.	1,090,084 lb.

The Agricultural Officer, Wundanyi reports as follows:—

“As previously indicated vegetable production suffered a severe setback during the first four months, owing to drought. Coupled with a falling demand in Mombasa this was injurious to the industry at the time and subsequently when production had recovered. Unwisely the growers of the Teita Vegetable Company insisted on a return to their wartime price of ten cents per pound at Wundanyi. In consequence good customers have turned to other sources for their supplies. The lack of maize meal during the last quarter lead to a reduction of acreage under vegetables. Maize was interplanted with vegetables, and in many instances has completely replaced them on plots formerly devoted to this valuable crop.”

Cashew Nuts.—Production is steadily increasing and the crop is now of first importance. There are an encouraging number of trees being planted and numerous young trees are now coming on throughout the coastal belt from Lamu to Vanga.

The 1945–46 crop was a record and there is every indication that the 1946–47 crop will also be large.

1945–46 crop:—

Kilifi	699,140 lb.
Digo	500,125 „
Malindi	390,805 „
Mombasa	86,457 „
Lamu	7,428 „
Total ..	1,683,955 lb. or nearly 752 tons.

The price paid to the grower was 12 cents per lb. giving a return to the growers of approximately £10,104.

Year	Raw nuts produced	Price per lb.
1941–42	833,737 lb.	5½ cents
1942–43	1,164,167 „	5½ „
1943–44	1,162,560 „	6 „
1944–45	567,502 „	8 „
1945–46	1,683,955 „	12 „

The price paid for the 1946–47 crop is 10 cents per lb.

Simsim.—The crop, the Black type, was fairly good especially in the Malindi District and is well suited to the light soils and humid atmosphere of the coast. It is rather surprising that more of it is not grown in the south. Practically the whole crop was used locally.

Copra.—There was a considerable increase in production probably due to a good season, better prices and a decrease in the sale of green coco-nuts to Mombasa. Lamu growers turn out the best quality product and recently a higher price was given them than elsewhere. The application of manure in the coco-nut plantations in Lamu is a common and gratifying sight.

Production:—

1944	..	..	..	..	1,000 tons
1945	..	..	..	..	250 "
1946	..	..	..	..	1,783 "

The price was raised in 1946 from Sh. 6/50 and Sh. 6/75 per frasila to Sh. 9/25 and Sh. 9/50 respectively for local and plantation products.

Rice.—There are indications that the acreage under this crop is increasing, but the local demand is so great that practically the whole crop is disposed of locally, considerable quantities being hulled by hand. It was not a particularly good year for rice as during the Long Rains many of the swamps failed to fill up and in the excessive Short Rains much of the Tana River crop was spoiled.

Green Gram and Cow Peas.—These are both economic crops in so far as they are largely grown for sale and provide a considerable source of revenue to the growers. Excellent crops were harvested this year.

Rubber.—There was no production during 1946.

Kapok.—This is a steady crop on the coast, but it is not particularly popular in spite of the demand and comparatively good price (25 cents per lb.) probably due to harvesting difficulties and the long time necessary for trees to come into production.

Production:—

				Price per lb.
1945-46	..	..	5,561 lb.	20 cents
1946-47	..	..	7,874 "	25 "

Tobacco.—Production was well maintained to meet the demand of the snuff makers who flourish locally.

Fruit.—The coast is renowned for the great variety and quality of its fruit. It was a good year and large quantities came on the market. On occasion the supply swamped the demand and prices dropped very considerably. The depopulation of Mombasa reduced the local demand much below what it had been during the war years.

Cotton.—In the main cotton growing areas the 1946-47 season was one of the best on record, the weather was eminently suitable, the thorough soaking in the Short Rains gave good growth and boll formation and was followed by a good dry picking season. Pests and diseases were remarkable by their absence.

In the Lamu District the people seem to have gradually got tired of cotton growing and the acreage was considerably less than in previous years.

	1944-45	1945-46
Malindi ..	1,070 bales	613 bales
Lamu ..	33 "	82 "

The 1946-47 crop is expected to yield over 1,500 bales at Malindi, but only about 40 bales at Lamu.

Coffee.—A nursery has been started at Wundanyi in the Teita Hills, with a view to developing a controlled coffee production by the Wa-Teita.

General.—The following table gives the amounts of the main produce sold for export from the Native Reserves on the coast.

Value to the Producer

		£
* Fresh Fruit	—	30,000
Fresh Vegetables	1,090,084 lb.	5,450
Cashew Nuts	1,683,955 „	10,104 (1945–46)
Copra	1,783 tons	44,575
Seed Cotton	878,411 lb.	6,991 (1945–46)
* Simsim	360 tons	4,450
* Rice	720 „	6,336
Chillies	19 „	1,060
* Legumes	420 „	5,720
Total		£114,686

Exports of Live Stock, Hides, Skins, Ghee, Milk would be the concern of the Veterinary Department and Timber, Firewood and Charcoal that of the Forestry Department.

Soil Conservation

The comparative flatness and good cover in the coastal areas are a natural aid to Soil Conservation and although the care of the soil has first priority in the agricultural activities of the coast it is not nearly such a difficult problem as obtains in many native lands elsewhere in the Colony. In the Teita Hills, however, an excessive population is pressing hard on a land of steep slopes. Soil Conservation is led by five teams of Line Levellers. Whole areas were contoured from the top to the bottom, irrespective of *shamba* boundaries. Lines of trash on cultivated land were made the universal rule; these were then planted with an indigenous *Coleus* species during the rains. Since it is the practice to hoe downhill, it is only a few seasons before bench terraces are formed. There is good progress to report in this direction and in the building of stone walls, in Mwanda location particularly. Owing to the failure of narrow-based terraces in the hills, a return was made to live wash-stops. The average cultivated slope in the high elevations has been calculated at 24 per cent. This indisputable fact, and excessive degree of fragmentation in all the top areas has forced this conclusion. In the gentler sloping foothills the means of conservation advised is that of narrow-based terracing. During the year some good work was done in these areas, following the contouring by the Soil Conservation Service Leveller.

In Mbololo beyond the foot of the hills the use of broad-based terraces at regular intervals of one hundred yards alternating with lines of thorn trash has been advocated. The work of extension on this scheme has made good progress. The Wa-Teita are showing increased interest in the Soil Conservation work, due to the realization of its urgent necessity on cultivated land.

A total of 1,206 miles were contoured for trash lines and wash-stops and 33½ miles of contour banks were completed.

In the Mambrui Hills near Malindi 17 miles were contour banked.

Progress has been made in the protection of river banks especially the Galana River.

Grass fires caused considerable alarm and are still widespread during two dry seasons throughout the Province. Efforts are being made in each district to control this menace.

* Estimated.

Education

The need for an Agricultural Training School is becoming more and more urgent as the demand for Agricultural Instructors increases.

In the Voi District the Primary Schools at Mbale and Bura were visited by the Agricultural Officer, short lectures were given and school plots were inspected.

The Agricultural Instructor for schools carried out a monthly programme of lectures at elementary and primary schools throughout the year.

Experimental

Kibarani.—Routine observational and seed selection plots of the following were maintained:—

- (1) Yellow Durum Maize.
- (2) Sunflower.
- (3) Dwarf *Hegari Mtama*.
- (4) Finger Millet (*Wimbi*).
- (5) Foxtail Millet.
- (6) *Njugu mawe*.
- (7) Pigeon Pea.
- (8) Groundnuts.
- (9) Sweet Potatoes vars. (ex-Nyeri).
- (10) *Crotalaria juncea*.
- (11) Grass spp.
- (12) Cotton

Silicophosphate trials showed no significant result. In the maize spacing trial $3' \times 3'$ gave better yields than $3' \times 1'$ or $3' \times 2'$. The trial is being continued.

Nursery.—A piped and tapped water supply was installed and completed in September. From this date ten Citrus varieties were imported as budwood and established on existing stocks.

Seed of Rough Lemon and Sweet Orange was imported from South Africa for growing on as stock.

A few local lime seedlings were issued.

Wundanyi.—The development of the 40-acre farm is under way and the area for cultivation has been contour terraced. The Agricultural Officer, Wundanyi, reports as follows:—

"Field Crops.—In April the Kinongo variety of English potato was planted together with other varieties for an observational trial of resistance to late Blight. The season was dry and no incidence of the disease was noticed, although the whole crop was reduced by Bacterial Wilt. Wheat planted in the long rains was destroyed by grasshoppers. The second planting was promising well until several days before harvest, but the unusual spell of heavy rain in September caused sprouting in the ear and the crop was spoiled.

Wimbi which was planted during the short rains failed to germinate. Yellow Durum maize and Canadian Wonder beans were planted during the Short Rains for the bulking of seed as a precaution against further shortages.

On the advice of the Senior Agricultural Officer, Pasture Research, seed of Nzoia Rhodes Grass and *Bromus Marginatus* was introduced for trial. Germination was fair, further comment would be premature at this stage.

Nurseries.—New varieties of peas and beans were tried and were successful, they were recommended to growers. The production of seed of lettuce, parsnips, cabbage and beans was continued, although later it was decided that it would be more advisable to import and distribute selected seed, when its value had been proved under conditions in the hills. Indian spices were successfully tried; further trials will be necessary before steps can be taken to encourage their production as a commercial crop in the hills. Raspberry canes were introduced for the same purpose. The Wa-Teita have shown little interest in strawberries despite the good crops shown in the nursery for many years now. Their rapid deterioration on the journey to Mombasa is the only drawback.

At the end of the year a further area was being cleared for the trial and extension of fruit. Cuttings of stone fruit were planted for this purpose.

Seed of two selected types of coffee from the Scott Agricultural Laboratories was planted in October. The germination of D.R.II was fair, whereas S.L.34 was a failure.

Live Stock.—Owing to the shortage of food there is no progress to report. Until apparatus for spraying cattle is available it is not desirable to import a better type of cow for grading up.

The improvement of existing buildings has been held up by the lack of materials."

Research

Kibarani.—Mr. G. W. Jeffery, Temporary Entomologist has been engaged throughout the year mainly on cotton and maize pests.

Maize.—Work on maize stalk borer was undertaken.

A number of stalk borer moths were bred out, the incidence not being above normal. One *Noctuid* sp. was also bred out from the same material. This is as yet unidentified. With the planting of material for investigation next year it is hoped to obtain further specimens for identification.

A *Crambus* sp. was found early in the year living in the curled tips of young maize plants. From these two very small *Diptera* sp. were bred out. These again are as yet unidentified but may prove to be parasitic on the *Crambus*.

Cotton.—Observations have been carried out on a one acre plot on the farm, and thirty bolls examined weekly. At first only records were kept of the stainer population, percentage of staining, punctures per boll, and percentage of pink boll worm present. Since 3rd October, 1946, more detailed examinations have been carried out.

Plain per centage counts were also made on bolls submitted from the Reserve.

Botanical.—Some four hundred specimens have so far been named by Mr. P. Greenway of Amani, and a further one hundred and seventy have been forwarded to the Royal Botanic Gardens, Kew. Sheets of all specimens have been sent to the Botanist, Coryndon Museum.

It should eventually be possible to use this material in the investigation of alternative host plants of economic pests, and possibly in the trials of indigenous stock plants for fruit trees.

Agricultural Operations, Taveta.—A separate detailed report by the Agricultural Officer in charge has been submitted.

African Settlement—Gede

The Department provided the services of an Indian Agricultural Assistant and six African Agricultural Instructors at Gede.

One of the Settlements is being developed by the Department as a demonstration.

Full reports on the Settlement are made by the Settlement Officer in charge and it only remains for me to report that the year was a prosperous one. Two hundred and ninety six plots are now occupied and only 72 remain vacant.

A scheme for Group Settlements has been started.

Pests and Diseases

Locusts.—Voi was the only district seriously affected. The 1945-46 campaign came to a successful end during February. A small amount of damage was done to crops on the lower slopes, despite every effort to prevent hoppers from reaching the cultivated areas. At the end of the year three small swarms arrived and laid eggs in Mbololo, near Tsavo and at Kasigau. The resulting hoppers were totally destroyed by beating and the use of D.N.O.C.

Vermin.—Wild pigs, porcupines and monkeys have been exceedingly destructive locally, especially in Digo District where a considerable staff of vermin poisoners is employed.

Aphis.—*Brassicæ* vegetables were severely attacked in the Teita Hills.

Mosaic Disease.—This disease of Cassava is still widespread and is probably due to the continued planting of impure stocks.

Conclusion and Acknowledgments

1946 was generally speaking a fairly prosperous year for producers on the coast. The potentialities for increased and more varied agricultural production are considerable. The main limiting factors to achieving this are the natural lethargy of the inhabitants in this humid warm climate, and the lack of field Agricultural Staff especially European to see that the projects are carried out.

Thanks are due to the Provincial Administration for their co-operation in agricultural matters, and in spite of the difficulties arising from the excessive changes in personnel, I should also like to express my appreciation to the Departmental Officers for their keenness and energy in carrying out the work.

M. H. GRIEVE,
Acting Senior Agricultural Officer, Coast.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, RIFT VALLEY PROVINCE, 1946

Staff

I was in charge of the Nakuru District and the Native Reserves of the Province throughout the year.

Mr. G. S. Cowley was on release from the R.A.F. posted as Agricultural Officer, Njoro, from July to October, when he was transferred to Machakos, Mr. Storrar taking his place on transfer from Kilifi via Kitale.

Mr. Newton was Assistant Soil Conservation Officer in charge until he proceeded on leave in June, being relieved by Mr. G. D. M. Baily who was in charge until Mr. Newton's return late in December.

Mr. G. Freeguard, A.S.C.O., was Inspector under the Land and Water Preservation Ordinance throughout the year.

Mr. G. Kelly, A.S.C.O., Grade II was stationed at Njoro throughout the year.

European Agriculture

The year under review was a very good one agriculturally. After a very dry spell at the beginning of the year, the weather was propitious throughout, though a dry July caused some anxiety.

Crop yields were on the average above those of 1945, the Mereroni and Njoro areas in particular doing well.

Maize also yielded well, and with the advent of picking machinery was not on some farms the problem to harvest it had been heretofore.

Pyrethrum in the Molo, Turi, Elburgon areas suffered a severe setback with "bud disease" and its future is causing some anxiety.

Stock

After a heavy diminution in milk yields during the early months of the year, cattle did better than for some time, the more general distribution of rain causing butterfat figures to stay up until the end of the year.

There were a number of pedigree bulls introduced from England and South Africa.

The numbers of sheep show a steady increase, and several farms have now built their flocks up to the maximum size, and are able to cull heavily. The ideal sheep for altitudes between 6,000-7,000 feet has not yet, however, been evolved.

With pigs there has been a general realization that, if producers are to stay in the market, they must be prepared to take a great deal more trouble over their feeding, and that the day when "any old pig would do" has gone.

Soil Conservation

In the Nakuru District the great majority of farmers wish to have their farms conserved, and the demand for terracing has been much greater than the services we have been able to supply.

The Soil Conservation Service of the Department has only had one "D"6 Tractor at work in the district, and other work has had to be done by hired tractors or, the farmers' own "D"4's.

During the year 4,150 acres were broad-base terraced, 44,600 yards of cut-off drains and drainage channels made, and 35,000 yards of farm roads constructed. A further 500 acres were narrow-base terraced by hand.

At the end of the year 15,000 acres were on our books awaiting terracing.

The Inspector under the Land and Water Preservation Ordinance made a complete inspection of all streams and valleys, and where cultivation was taking place near river banks it has been moved back. This task has taken some time, but the work has generally been done without friction.

Machinery Control

The Senior Agricultural Officer has been responsible for the working of this in the Nakuru District.

African Agriculture

Until 1946 there had never been a permanent officer responsible for Native Agriculture in the Rift Valley Province, consequently no organization existed in any of the districts which was controlled by the Department of Agriculture.

Whilst in districts such as Baringo and Samburu, the amount of land under crops is very small, other areas such as Elgeyo and Nandi are showing an alarming tendency to overcropping and exports for cash.

The lack of trained European agricultural staff has made intensive tackling of problems in the native districts of the Province impossible, and reliance has had to be placed on the staff of the Soil Conservation Service for help on betterment schemes. At the end of the year four such schemes were in being in the Province.

Nandi District.

Only the heavy rainfall enjoyed over most of this district has prevented overstocking, and in the Northern and Eastern end of the district overcropping, from becoming a serious problem years ago.

The present position together with the threat of the return of a large number of squatter stock from the Uasin Gishu and Trans Nzoia Districts made it imperative that something was done in 1946.

Two schemes were produced by Mr. K. D. S. MacOwan of the Veterinary Department, which, after some modifications were adopted by the District Team.

The first was a Pilot scheme for grazing and cultivation control in the Ndalat area or Trans Kipkarren in the Northern end of the district.

The second scheme was that of bush clearing in the Aldai or Southern end of the district. The first scheme included the fencing of the boundary of the district, together with areas in the Reserve for paddocking and re-habilitation of fertility.

By the end of the year the scheme was proceeding satisfactorily though work had by no means been plain sailing.

The difficulty had been to make the Nandi realize that a considerable amount of talk did not result in any appreciable amount of work.

Mr. M. Sholto Douglas, A.S.C.O. was put in charge of the scheme in August, and he set out to get to know the Nandi. He has been able to find out a great deal about the system of tribal control used in olden times, and an attempt is being made to build up tribal authority through the Kokwet Elders on a Pororiet or parish basis.

The parish boundaries are being marked and cultivation on river banks and other unsuitable places has been forbidden. The Kokwet Elders together with the local Committee of the scheme play their part in the decisions taken.

Two local European Settlers have also been invited to visit the scheme from time to time to see progress.

The *Aldai* or bush clearing scheme under the charge of Mr. E. C. Taylor made more actual physical progress, but in many ways will be the most difficult scheme to keep going efficiently. The bush is fairly easy to clear, but its rate of regeneration is such, that each area has to be gone over several times before any permanent improvement has been made.

By the end of the year 5,000 acres had been gone over once, and some of it twice. In *Aldai* there is not at the moment enough stock to keep the new areas of grazing properly eaten down, and some system will have to be found by which stock from the overgrazed areas in other parts of the district can be put into *Aldai* to assist in keeping back the fresh regeneration.

The position is, that whilst some parts of Nandi are very definitely overstocked, the cattle population in *Aldai* is not sufficient to maintain the improvements made with D.A.R.A. money.

West Suk.

Up to this year (1946) agricultural work in West Suk has been in the hands of the Education Department, but at a meeting at Kapenguria in November, it was agreed that an A.S.C.O. should be posted to the district to undertake a definite programme of pasture improvement; the Headmaster of the school to continue to look after the experimental plots. These plots have done some good and very essential work in showing what crops do well in West Suk district.

Elgeyo-Marakwet.

Owing to lack of European staff, it was not possible to give this district agricultural assistance.

The District Commissioner carried on the good work started by Mr. Storrs Fox with the experimental and seed bulking plots.

Elgeyo-Marakwet District has, however, reached the state when it is essential that it is provided with the services of an Agricultural Officer, not necessarily whole time.

The district contains three distinct types of country each with its own problems.

The high country and the cliff country of the Kerio Valley are very overcrowded, whilst the low valley bottom of the Kerio is practically uninhabited, and apart from some goats unused.

It is hoped to put up a scheme for the utilization of the Kerio Valley in 1947.

The Ground Nut Commission visited the area, and have advised that the middle part of the valley be exploited for ground nut production. The personnel of the Commission were very much impressed with the top of the valley, which they thought should be developed by the local Government.

Baringo District.

This is another area where it has been possible to give very little agricultural assistance.

Mr. Chaundy the Senior Agricultural Education Officer started and has looked after the demonstration plots for years, but no extension work has been done.

The main problem of the district has been overstocking, the grazing areas being reduced to a parlous condition by many years of over punishment.

A start was made in tackling this problem during the year under review, and schemes of rehabilitation were started on the fringe of the district at Solai in the Pokorr and Enderois locations, and in the Kisokon section of the old Uasin Gishu Masai Reserve. These were both progressing favourably at the end of the year. The future, however, depends on the degree of co-operation forthcoming from the Kamasia themselves.

Plans were formulated and passed early in 1947 for a much larger scheme at Esageri and Kisokon, whilst the Kamasia have started a voluntary cull of their stock, the results of which at the time of writing have exceeded our wildest hopes.

Mr. R. A. Langridge, A.S.C.O., is in charge of the Kisokon-Esageri scheme, and Mr. W. M. Spencer in charge of the Solai Border scheme.

Laikipia-Samburu.

I was only able to visit this district once in 1946. Mr. Simpson the District Officer has taken the greatest interest in the grazing control schemes, which are working very satisfactorily, but if the Laroghi Plateau is to carry its present high figure of stock, a great deal will have to be done in improving water supplies.

Early in 1947 the African Settlement and Land Utilization Board agreed to supply money for the purchase of oxen for dam making, and a comprehensive scheme of land utilization is being prepared for the whole district. Mr. Maher has promised an A.S.C.O. for the work.

Olenguruone Settlement.

A plan for the complete re-organization of the lay-out of this Settlement was prepared early in the year, but owing to staff and political difficulties was not put into operation until early 1947.

Until such time as the African Settlers realize that no amount of obstinacy will make crops grow at heights to which they are unsuited and take the advice given them to grow suitable crops, the Settlement will not go ahead.

Conclusion

The Rift Valley Province Native Reserves have now several D.A.R.A. schemes in being, the success of which in the main depends on two factors.

1. The degree of African co-operation forthcoming.
2. The standard of the European staff available.

Very great distances have to be covered to get round this Province, and the complete lack of trained agricultural staff in any of the out districts makes progress extremely slow.

C. O. OATES,
*Senior Agricultural Officer,
 Rift Valley Province.*

ANNUAL REPORT OF THE AGRICULTURAL OFFICER, NAKURU DISTRICT, 1946

Staff

There was no Agricultural Officer (Nakuru District) in the early part of the year and Mr. G. S. Cowley arrived in July. Mr. A. Storrar took over from Mr. Cowley on 1-11-46 and remained here for the rest of the year.

Weather Conditions

Except for the very dry spell at the beginning of the year the rains have been excellent, and after the rain commenced in April they continued right through to the end of September without a break.

There were annoying showers around harvest time especially in the Njoro area but they at least helped the dwindling grazing.

Rainfall records were as follows:—

<i>Month</i>	<i>Average of 18 years</i>	<i>1946</i>
	<i>Inches</i>	<i>Inches</i>
January	0.90	0.27
February	1.36	0.00
March	2.81	1.18
April	4.34	5.89
May	4.28	2.54
June	3.64	3.07
July	5.00	3.47
August	4.93	7.22
September	2.19	5.66
October	1.81	1.37
November	2.69	1.99
December	1.74	0.64
	35.69	33.30

Stock

Stock went short of grazing in the early part of the year, and once again emphasized the necessity of the farmers to conserve food for the dry period.

Crops

There was a poorish start this year, but the good distribution of rain later on saved what might have been a bad one.

Wheat yields in Mereroni and Njoro will average a good six bags, while the all over average will be round five bags. On the better farms yields of 10-12 bags have been recorded.

Maize yields will be quite good, and an average of about eight bags an acre is expected. Njoro and Subukia are above average and expect 10 bags per acre. The small quantities of oats and rye will yield quite well.

Machinery

Control of machinery is still in operation, and until such time as it is plentiful it will be best to continue so that full use can be made of the little available.

Soil Conservation

The Soil Conservation Service reports that during the year 1946, some 4,150 acres have been broad- base terraced and some 500 acres narrow-base terraced.

In addition 44,600 yards of cut-off drains and drainage channels, and 35,000 yards of farm roads have been constructed.

168,000 cubic feet of earth have been excavated in removing high spots in terrace channels.

Owing to the fact that there is only one "D"6 tractor owned by the S.C.S. and two rather old tractors on hire, progress can be considered satisfactory.

At the moment 15,000 acres await terracing, and as applications for terracing are a daily occurrence no doubt this figure will be much larger by the end of 1947.

Lack of machinery is the limiting factor in the Soil Conservation department.

Mr. Freeguard has continued as an Inspector under the Land and Water Preservation Ordinance, and all streams in the Subukia valley have been completely inspected, orders issued, and in every case the orders were complied with.

He made complete inspections of farms in Kedowa, Londiani, Mau Summit, Molo and Elburgon areas, and where cultivation was too near river banks it was moved back.

A typical catchment area (300 acres) at Olenguruone is at present being surveyed.

Marketing

Grading and Inspecting have been carried out at various rail heads throughout the year, and to increase efficiency re-organization will be made as from the beginning of 1947.

Experimental Work

The lack of an Agricultural Officer in the early part of the year and the frequent changes made any experimental work impossible.

Farming in 1947

A drop in the acreage under the plough is expected, but until prices of cereals drop we will be unlikely to have the community as a whole adopting a mixed farming system.

It may be said that the extra lands ploughed up during the war will tend to go back to grass again, as the farmer feels the onus on his shoulders due to the war has been removed.

We will have to wait a little longer to get the one crop farmers running along the right lines.

A. STORRAR,
Agricultural Officer.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, KITALE, 1946

Staff

Mr. R. E. T. Hobbs, Senior Agricultural Officer, was in charge of the Kitale Experimental Station and carried out general advisory work in connexion with crops and stock in the Trans Nzoia and Uasin Gishu Districts.

Mr. L. R. N. Strange, Assistant Agricultural Officer, was stationed in Eldoret and carried out general advisory work in connexion with crops in the Uasin Gishu District.

Mr. J. T. T. Schouten, Assistant Agricultural Officer, stationed at Kitale, was in charge of experimental and advisory work on coffee in all areas west of the Rift Valley.

Mr. R. G. Smith, Junior Laboratory Assistant, was stationed at Kitale for two periods of a month during the year to assist in investigations being carried out on Chafer Grub and Maize Stalk Borer.

Mr. D. Wolff, Field Assistant was managing the Waterkyn Farm.

Meteorological

Rainfall for the year was above average and was marked by incessant rain in July and August and exceedingly heavy fall occurred during the latter month. Due to this heavy rain the ground was in a water-logged condition during July and August and this had an adverse effect on maize and wheat yields.

<i>Rainfalls</i>	<i>1946 Inches</i>	<i>13 Year's Average Inches</i>
January	0.08	0.50
February	0.54	1.57
March	1.37	2.30
April	6.40	5.90
May	6.99	7.14
June	8.55	5.29
July	6.93	6.29
August	12.06	6.85
September	4.96	3.90
October	1.80	2.17
November	1.63	2.26
December	1.20	1.33
Total ..	52.51	45.50

Storms of the following intensities were recorded on the Friez Self-recording rain gauge:—

<i>Date</i>	<i>Total Fall</i>	<i>Intensity</i>
14-4-46 ..	1.43 inches ..	1.00 inches in 10 minutes
18-5-46 ..	1.34 " ..	0.50 " " 10 "
31-5-46 ..	1.63 " ..	0.80 " " 10 "
27-6-46 ..	1.71 " ..	1.71 " " 30 "
22-7-46 ..	0.92 " ..	0.90 " " 10 "
26-8-46 ..	1.56 " ..	1.20 " " 20 "
29-8-46 ..	1.19 " ..	1.10 " " 10 "

Experimental Station

The acreages under cultivation of various crops during the year were as follows:—

	<i>Acres</i>
Coffee	21
Maize	39
Ensilage (Maize) .. .	29
Fodder (Oats)	11
Green Manure	11
Nursery and trial plots .. .	4
Temporary grass ley .. .	45
Improved veldt grazing .. .	214
Tree plantation and wind breaks .. .	42

The farm rotation has been replanned as it was found out that, even with heavy applications of farm yard manure and green manuring, the fields which had been under annual crops for a period of years were beginning to go back, applications of manure having only a temporary effect and run-off water from the terraces increasing in volume due to lack of structure and absorption by the soil. The 160 acres of arable land have therefore been put on a six year rotation as follows:—

1st year: Maize.

2nd year: Fodder plus 15 tons per acre Farm Yard Manure.

3rd year: Maize underseeded grass.

4th year: Grass.

5th year: Grass.

6th year: Grass.

This rotation whilst providing full grain and fodder requirements for the farm, will, it is hoped, eliminate much of the hand weeding required for maize as, in the first year, the crop will be grown on land newly broken from ley, weed growth being slight, and, in the third year the crop is underseeded with grass requiring no cultivation, as has been proved by former trials. Cultural and manurial experiments will be laid out on the various fields, which roughly conform to soil types, and will follow through the course of the full rotation. A new implement and tractor house have been built and also a mill house. A 1,000 feet of 1 inch piping in the pump delivery line were lifted and changed to 1½ inch, to enable a better delivery of water to be obtained from the present pump. The farm has been extended on to 25 acres of township land which was fenced in and cleared for grazing during the year. A Farmall "H" Tractor and full range of attachable implements has been purchased for the farm; this will enable work oxen, except those essential for the making of manure, to be dispensed with and their place taken by dairy cattle; it will also enable mechanized maize farming to be tried out.

Expenditure and revenue during the year were as follows:—

Expenditure—

<i>A.—Capital.</i>	<i>Sh.</i>	<i>cts.</i>
Implements (Tractor, etc.) .. .	17,707	85
Building and water supplies .. .	3,103	79
Fencing	810	58
Live Stock	—	—
Labour and Rations	1,967	13
Total .. .	23,589	35

B.—Running.

Manure, Seeds, Sprays	1,555	11
Repairs, Renewals and small tools	2,568	33
Feeding Stuffs and Veterinary	3,708	14
Miscellaneous	623	33
Labour	8,018	41
Rations	1,485	04
Fuel, Oil and Lorry Transport	2,553	83
Total ..	20,512	19

Revenue—

Sale of Pigs	8,097	91
Sale of Coffee	2,811	63
Sale of Butterfat	1,620	69
Sale of Milk	962	36
Sale of Live Stock	2,257	83
Total ..	15,750	42

Crops

Maize.—The maize acreages in the Trans Nzoia and Uasin Gishu for the six years 1941–46 are as follows:—

	1941	1942	1943	1944	1945	1946
Trans Nzoia ..	40,000	37,649	47,886	55,006	58,906	51,389
Uasin Gishu ..	12,512	14,933	21,266	25,044	26,126	22,405

The reduction in the total acreage in maize in the two districts is in the main due to shortage of labour and worn out lands. It has been to some extent, but not entirely, replaced by wheat in those areas suited to the crop.

Average yields in bags per acre for the five years 1942–46 are as follows, the yield for 1946 being an estimate:—

	1942	1943	1944	1945	1946
Trans Nzoia	8.5	8.3	8.3	7.3	7.1
Uasin Gishu	5.3	5.9	6.6	4.7	5.8

In the Uasin Gishu it was a slightly better maize season than the previous year, but in the Trans Nzoia heavy July-August rains and water-logging of the soil caused chlorosis and reduction in yield, notably in the higher yielding areas on Elgon, where over 20 inches of rain fell in August. Labour difficulties and poor cultivations, in a year when weather was conducive to weed growth, also contributed to the reduction in yield. Considering the heavy rain the incidence of disease, such as Pink Ear Rot, was not heavy.

Wheat.—The wheat acreage in the Trans Nzoia and Uasin Gishu for the six years 1941–46 are as follows:—

	1941	1942	1943	1944	1945	1946
Trans Nzoia ..	8,000	7,651	7,224	8,709	10,714	13,078
Uasin Gishu ..	45,816	57,724	60,921	67,313	74,682	87,679

Average yields in bags per acre for the five years 1942–46 are as follows, the yield for 1946 being an estimate:—

	1942	1943	1944	1945	1946
Trans Nzoia ..	4.1	4.9	4.5	4.6	3.9
Uasin Gishu ..	2.5	4.2	3.3	4.3	3.7

The year, having promised well at the start, was a disappointing one for wheat due to the following reasons:—

- (a) Exceptionally heavy rain during the growing months of July and August with water-logging and poor fertilization, with the result that, in many instances, good stands of strong straw gave surprisingly low yield of grain. On Elgon, where the land is usually planted to a green manure crop preceding wheat, great difficulty was experienced in ploughing these crops under, due to heavy rains, and much wheat was late planted.
- (b) A shortage of essential fertilizer. Allocation of available superphosphate gave farmers under 20 lb. per acre, which is insufficient for most soils. Uganda Rock Phosphate was in free supply, but was not popular owing to slowness of action.
- (c) Stem Rust was not widespread, but did reduce yields in some instances. Leaf Rust and Glume Blotch were prevalent and may have been responsible for some lowering of yield and quality.
- (d) Compulsory ploughing in of straw from the previous harvest caused chlorosis and slight loss of crop on some farms.

In the Uasin Gishu varieties are tending to become very mixed, due, in the main, to the wider use of combine harvesters, and the production of pure seed is becoming an urgent necessity. If growers are to be found for pure seed, however, a greater premium per bag, to recompense them for trouble and labour, will have to be paid than is the case at present.

Rye.—With the complete failure of this crop from stem rust in 1945 none was grown in 1946.

Flax.—With the cessation of guaranteed markets, and the increase in price for cereal crops only a very small acreage was planted to flax in 1946, mainly by growers who had their own processing facilities. The 1945 crop, scutched in 1946, was more satisfactory as regards quality than the previous year, giving an average of Grade 4. As regards the future of this crop, it is probable that none will be grown in the lower areas, and only small amounts in the higher areas, where the crop does better.

Coffee.—The trees benefited from the heavy rainfall and yields have been above average.

Barley.—A small acreage was planted, mainly for feed purposes. Yields were lower than last year due to excessive rain.

Oats.—Small acreages for feeding purposes and for hay were planted on most farms. Leaf rust and loose smut were prevalent due to excessive rain.

Pyrethrum.—Yields have been fair with an average of 250–300 lb. of dried flowers per acre. Greater concentration on smaller acreages would pay with this crop.

Black Wattle.—There is now approximately 14,600 acres under wattle of varying ages in the Uasin Gishu. The East African Tanning Extract Company has purchased about 25,000 acres of land in various parts. Most of this will be planted with wattle with a view to ensuring adequate supplies of green and dried bark for the extract factory which is to be built—probably near Eldoret Township.

It seems likely that the recent increase in price of bark will encourage farmers to plant more and that the wattle industry is destined to play an important part in the economy of the district.

Fruit.—During the year considerable attention has been given to the possibilities of commercial fruit growing. It is believed that most parts of Turbo-Kipkarren-Soy Hoey's Bridge and Moiben Valley are well suited for the produc-

tion of citrus fruits (except grape fruit), while deciduous fruits can, given the right varieties and correct management, become an important sideline on the majority of farms in the Plateau and Elgon areas.

There is always a local demand, at present supplied largely by imports from abroad, for a well graded and good quality product, while fruit juice and canning factories will provide an outlet for any surplus which may be grown.

Pests

Chafer Grub.—This pest was not nearly so widespread as in previous years, although slight crop damage was reported from scattered sources. Investigational work on control continued.

Stalk Borer.—This continued to be a major pest in maize, especially in the lower areas. The results of investigational work on control and the life history of the grub are given in the latter half of this report.

Locusts.—Owing to successful control in Turkana, no damage was suffered by any crops.

Noxious Weeds.—The spread of *Datura stramonium*, Darnel and Wild Oat continues, especially in the wheat growing areas of the Uasin Gishu. Whereas much of the infestation is due to farmers using unclean seed the control of these weeds will never be effected, whatever legislation may be enacted, until a change over is made from one crop farming method to alternate husbandry.

Soil Conservation

With the posting of Soil Conservation Inspectors to both districts, the work of preventing destruction to stream banks and the closing of worn out arable lands to cultivation has proceeded more rapidly. Upwards of 150 orders have been served on farmers under the Land and Water Preservation (General) Rules during the year.

It was hoped to get the Land Conservation Rules, 1945, approved by the Uasin Gishu and Trans Nzoia District Councils, which would have eased the work entailed in serving orders on individuals, but the councils refused to agree to these rules except under certain conditions.

After four years of arable cropping much of the land, especially on the lighter soils, is beginning to show visible signs of deterioration and many more closure orders will be necessary in the near future. Regarding these orders the writer would like to reiterate what he said last year, in that, whilst they prevent the ultimate destruction of the piece of land in question, they do not prevent the process of land exhaustion continuing. There must be a radical change in farming methods if a permanent agriculture is to survive; methods have been worked out on the Kitale Experimental Station which are both economic and practical and farmers are being urged to adopt them.

Routine and Advisory

Numerous visits were paid to farmers to advise on general farming matters and a considerable amount of time has been spent on work in connexion with the Increased Production of Crops Ordinance.

The Waterkeyn Farm, purchased by the Department should an overflow be needed for the Egerton School, was managed by Mr. D. Wolff under supervision by the Senior Agricultural Officer, Kitale.

Several meetings of local farmers' associations were attended and addressed during the year and two farmers' days, one in conjunction with the Veterinary Departments, were held on the Kitale Experimental Station.

Investigational

Fertilizer Trials.—Statistical trials were carried out at Eldoret and Kitale to test the effect of various phosphatic fertilizers. Wheat was used as the crop in the Eldoret and Rye in the Kitale trials.

<i>Eldoret</i>	<i>Dressing per acre</i> <i>lb.</i>	<i>Yield per acre</i>	
		<i>Grain</i> <i>bags</i>	<i>Straw</i> <i>tons</i>
Silicophosphate	185	2.83	0.71
Super phosphate and Uganda Rock phosphate mixture	190	2.04	0.52
Uganda Rock phosphate	285	1.70	0.49
Control	Nil	1.78	0.40

The reason for the low yields is that the trial was carried out on land newly broken from veldt. Silicophosphate and Super-rock mixture gave significant increase in yield over control.

<i>Kitale</i>	<i>Dressing per acre</i> <i>lb.</i>	<i>Yield per acre</i>	
		<i>Grain</i> <i>bags</i>	<i>Straw</i> <i>tons</i>
Silicophosphate	185	9.99	3.60
Uganda Rock phosphate	285	8.10	3.29
Super phosphate and rock phosphate mixture	190	6.36	2.88
Control	Nil	5.21	2.81

Silicophosphate and Uganda Rock phosphate gave significant increase in yield over control and super-rock mixture

A statistical experiment was carried out to test the effects of varying rates of applications of Uganda Rock phosphate and silicophosphate, the fertilizers being placed with the seed at time of planting. This trial will be continued through a six course rotation, the fertilizers being applied each year during the first three years, when the land is under arable crops, and residual effects tested out on pastures during the last three years of the rotation. Treatments were as follows:—

- A. Control.
- B. Silicophosphate 100 lb. per acre.
- C. Silicophosphate 200 lb. per acre.
- D. Uganda Rock Phosphate 200 lb. per acre.
- E. Uganda Rock Phosphate 400 lb. per acre.

Tabulated results in bags per acre for the first year's crop, which was maize, are as follows:—

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>	<i>Mean</i>	<i>Standard Error</i>
	21.36	25.20	23.02	22.32	23.2	22.93	1.45
Per cent of mean	93.2	109.9	100.4	97.3	100.4	100	6.3

There was no significant difference between any of the treatments. It was noticed that the heavier application of silicophosphate was apt to "burn" the seed and affect germination.

Burning of Crop Residues.—Owing to the considerable arguments which have arisen concerning the merits and demerits of ploughing under wheat straw, especially on the shallow soils overlying murrum on the Uasin Gishu Plateau, and its effects on the following crop, a trial was started on a farm in that area which will be continued for some years. The layout consists of eight two-acre strips the straw being ploughed under on alternate strips and burnt on the rest. Planting was done across the strips to avoid any possible error in the rate of fertilizer

application and, at harvesting, yield figures were computed by cutting six 1/40th acre randomized plots in each strip. In 1946 yields per acre for the two treatments were as follows:—

- | | |
|------------------|---------------------|
| 1. Burnt | 4.25 bags per acre. |
| 2. Unburnt | 4.05 bags per acre. |

Pasture Trials.—These have been confined entirely to work on grass leys. The comparatively high and assured rainfall enjoyed by both districts, combined with the fact that 75–90 per cent of the land on all farms, with the exception of those in the Burnt Forest and Elgon areas, can be brought under the plough, must lead ultimately to the adoption of an intensive arable—ley farming system. There is also the problem of reconditioning old lands worn out by continuous cereal cropping. Trials have been conducted in the past few years to find suitable grasses and methods of seeding down grass leys, preferably under a nurse crop; at the Kitale Experimental Station, good swards of Nzoia Rhodes Grass (*Chloris Gayana*) and Molasses Grass (*Melinis Minutiflora*) have been established under maize, and, providing a clean seed bed is obtained, no weeding of either crop is necessary. This served for those areas of the Trans Nzoia and Uasin Gishu situated on the metamorphic soils, but no grass, or method of establishment, had yet been tried on the shallow volcanic loams of the Uasin Gishu, where wheat is the main crop and a change over from one crop farming is an urgent necessity. In 1944, co-operative experiments were started on the farm of the Hon. W. A. C. Bouwer, M.L.C., near Eldoret, at an altitude of 7,300 ft. with a 40 in. rainfall, situated on soil of the Plateau brown loam type.

The objects of the experiments were:—

1. To find suitable grasses for temporary leys for the Plateau area.
2. To find the most suitable method of establishment, special attention being paid to establishment under a nurse crop.
3. To make observations on the effect of phosphatic fertilizers on the growth of leys.

With these objects in view the following trials were carried out:—

1944—

1. Three adjoining blocks were seeded to *Bromus Marginatus*, Molasses grass and Nzoia Rhodes grass in May at seeding rates of 25 lb., 10 lb. and 15 lb. per acre respectively.

2. Three adjoining blocks were seeded to the same grasses in June under a nurse crop of wheat.

1945—

1. In June, two adjoining blocks, each consisting of six strips, were drilled with wheat at varying seeding rates. Rates used were 75 lb., 60 lb. and 45 lb. per acre; treatments were repeated twice in both blocks. One block was then sown with Molasses grass and one with Nzoia Rhodes grass. After sowing, strips of Uganda Rock phosphate and super phosphates were drilled in across both blocks at rates of 600 lb. and 100 lb. per acre respectively.

1946—

The trials carried out in 1944 were repeated omitting *Bromus marginatus*. After seeding, strips of Uganda Rock phosphate and silicophosphate were drilled across the grass strips at rates of 372 lb. and 168 lb. per acre respectively.

Conclusions to be drawn from these trials are as follows:—

1. Both Nzoia Rhodes grass and Molasses grass are suitable for temporary leys in this area and will give excellent grazing for at least three years. *Bromus marginatus* is not suitable owing to its inability to form a sward and withstand the dry season.

2. On land of medium or good fertility the sowing of Rhodes or Molasses grass under a wheat nurse crop is a more satisfactory method of establishing a pasture than sowing the grasses by themselves. The reasons for this are that, although a dry season's grazing is lost when the grass is seeded under wheat, the nurse crop controls weed growth, an extra crop is obtained whilst the grass is being established and a year's cultivations are saved.

3. Lighter seeding rates for wheat made no visible difference to the subsequent growth of the grass and the sward obtained. It is interesting to note that the lighter seeding rates also made no difference in yield of wheat.

4. Applications of Uganda Rock phosphate and super phosphates showed a beneficial effect on the growth of the grass; more so on Rhodes than on Molasses.

Trials were also carried out on methods of seed harvesting and it was found that seed of Rhodes and Molasses grass can be reaped mechanically by cutting with a reaper and binder, drying in the field, and then threshing either by hand or with a combine harvester fitted with the necessary screens or cleaning device.

Pasture Legumes.—One of the main problems with ley pastures is to find a suitable legume. Lucerne has been tried seeded at the rate of 2 lb. per acre with Nzoia Rhodes grass, but it only lasts one or, at the most, two seasons. A collection of indigenous legumes is being made and an annual red clover, *T. Studenerii* shows promise, it gives a prolific growth and seeds readily. Seed has been bulked sufficient for a field trial next season.

Insect Pests.—Investigations were made in collaboration with the Senior Entomologist on the following:—

(a) *Chafer Grub.*—Experiments on the control of this pest were continued. Field and plot trials were conducted using varying applications of Gammexane per acre. No results were obtained from the field trials but in the plot trials, where known grub populations per acre were put in at the same time as the Gammexane and the seed, flax being used as an indicator crop, the higher applications of the insecticide appeared to exercise some control on damage to the crop.

(b) *Stalk Borer.*—Experiments were designed to test out the efficiency of various control measures on this pest and an investigation was made to determine the life history. The following insecticides were used as top dressings when the grub was in the funnel of the plant:—

1. Derrisol at 1:1,000 solution.
2. Derrisol at 1:600 solution.
3. D.D.T. dust (one per cent).
4. Gammexane dust (ten per cent).
5. Sodium fluosilicate, 1:500 solution.

Of these, D.D.T. dust and sodium fluosilicate gave the best control.

Investigations into the life history of stalk borer showed that two and possibly three life cycles can take place during the growing season of maize in this area. Out of season maize, planted in July, had an exceptionally severe infestation of grubs from the second generation, and showed that the gazetting of a close season for maize planting was well justified. There would appear to be a carry over of grubs and pupae in dry stalks and cobs and, where infestation has been severe, composting or burning of these is suggested.

Conclusion

This report would be incomplete without recording the co-operation and assistance of farmers, the hard work done by Mr. L. R. N. Strange, Assistant Agricultural Officer, Eldoret, and the assistance given by Mr. J. T. T. Schouten, Assistant Agricultural Officer, Kitale, in the running of the Kitale Station.

R. E. T. HOBBS,
Senior Agricultural Officer.

**ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER,
RUMURUTI (LAIKIPIA, NAIVASHA AND NORTH NYERI DISTRICTS),
1946**

Meteorological

For the fourth year in succession the early rains were practically a failure over most of the area, but precipitation later in the year was good. In the Laikipia District extremely dry conditions were experienced up to May, when the major rains commenced and thereafter they continued to be fairly normal for the remainder of the year. In the Naivasha area rainfall was up to average and the distribution was excellent.

North Nyeri District, generally speaking, experienced severe drought conditions during the first three quarters of the year, although the October-November rains were fairly good.

At Ol' Joro Orok the evaporation measured 49.128 inches of water for the twelve months.

Crops

General.—Efficient preparation of the land and destruction of self-sown grain and weed seeds was retarded by the dry weather early in the season, while heavy rains at planting time interfered with sowing. Despite this, crops grew away well, and although it was at one time thought that yields per acre would be below the 1945 figures, the harvest has proved surprisingly good and above expectations.

Throughout the three districts there was only a very slight increase in the acreage under crops, but Naivasha District will show an increase in 1947, mainly on the Kinangop plateau, where experience has shown that selected areas of this grey soil can be cultivated with good results providing it is broken at least six months before planting and that also the crops receive a phosphatic fertilizer.

The following figures show the increase in acreage under cereals during the past eight years:—

<i>Grain Crop</i>	1938		1942		1946	
	<i>Acres</i>	<i>Yield Bags</i>	<i>Acres</i>	<i>Yield Bags</i>	<i>Acres</i>	<i>Yield Bags (approx.)</i>
Wheat	4,530	13,733	21,348	62,348	38,398	184,494
Barley	777	4,662	1,399	8,394	2,338	12,738
Oats	368	2,576	1,354	9,478	2,018	13,174
Maize	1,533	10,948	678	2,534	859	4,283
Rye	97	500	533	1,517	—	—
Totals ..	7,395	32,419	25,313	84,046	43,613	214,689

Although it is dangerous to judge true development on increasing cultivation, it is nevertheless fair to say that there has been a tendency, during the year, to a more balanced farming. Machinery has been in short supply, and this has seriously interfered with the programmes of both established farmers and new settlers alike; unless greater supplies are forthcoming, 1947 may well see a reduction in development and cultivation.

Wheat.—In the higher areas there has been a swing towards larger acreages of "Equator" (locally known as K.T.I.) and a corresponding reduction in No. 117A. The latter, although it yields excellently, not only tends to lodge and increase harvesting difficulties, but also is apparently becoming more susceptible to Yellow Rust at the higher elevations. In the intermediate regions D.C. x Ceres, 117A, N.B. 230 and Sabanero continue to grow well, while 192 has given good results in the lower and warmer areas.

Rye.—Owing to its susceptibility to Stem Rust, this crop has now been abandoned.

Barley.—Excellent crops of barley have been secured; two years ago Maltworthy showed great promise, but as a general purpose Barley Prior continues to hold its own against the more recent introductions.

Oats.—A satisfactory increase in acreage has taken place and farmers are slowly realizing that in oats they have not only a grain for sale, but also an excellent stock feed and a hay and silage crop of the greatest value.

Flax.—The growing of Flax has been abandoned.

Pyrethrum.—This crop gave disappointing yields; it was late in flushing owing to the delayed rains and flowering ended abruptly after a spell of unusually dry and desiccating weather in November.

Potatoes.—The acreage has tended to decrease mainly because of the risk from late blight and also because of labour difficulties.

Vegetables.—Following the withdrawal of Military Forces from Nanyuki and Gilgil the growing of vegetables has not been so extensive as during the war years.

Stock

Cattle.—The cattle industry suffered from protracted dry weather during the first part of the year, but conditions improved rapidly after the onset of the rains and the year ended successfully, both from a dairying and ranching point of view. The following are supplies of butterfat to the three creameries in the area during 1940, 1942 and 1946:—

SUPPLIES OF BUTTERFAT TO CREAMERIES (IN LB.)

	1940	1942	1946
Naivasha	878,200	1,229,220	1,631,357
Thomson's Falls ..	520,783	775,800	856,326
Nanyuki	666,554	911,760	714,478
	2,165,537	2,916,780	3,202,161

During the year these three creameries manufactured 3,811,435 lb. of butter.

Although production of "home grown" fodders is increasing slowly, the quantity of silage and hay made is far below the needs of the cattle. Breeding is in advance of feeding and many farmers place too much reliance on purchased concentrates; indeed, it is safe to say that instead of home grown fodder, a large proportion of concentrates is used wastefully as a "maintenance" ration.

While farm water supplies are being improved, there is, generally speaking, too little attention paid to watering facilities, and cows in milk are frequently expected to walk four to ten miles a day to grazing and water. The former distance is often covered by cows on relatively small farms, where they are milked twice a day. It is felt that with the quality of cattle on many farms there is a very large latent or potential milk yield which could be made available if only cattle were given correct treatment. It may be argued that the immediate problem of economics arises, but in any case the question resolves itself into an extensive or intensive system of cattle farming and whether a system of farming is being adopted which is within the scope of the natural controls. In the past there has been, in the lower and "sweet grazing" areas, a great tendency to dairying which, because of the limitations of natural controls, has caused deterioration of grazing and of land. On the other hand, in areas of higher rainfall and where the conditions are conducive to a more intensive type of agriculture, one finds all too frequently dairy herds being run on what is tantamount to an extensive system.

Sheep.—Flocks have done well during the year and wool clips have been good. There was a general tendency, on most of the large sheep farms, to reduce

the numbers of sheep and replace these by cattle, as it is being realized that a rapid deterioration of the pasture occurs where it is only kept in a condition suitable for sheep grazing.

Pigs.—During the past six years the pig industry in the area has had a chequered career for many reasons, but this branch of farming is now settling down to those areas which have not only adequate supplies of separated milk, but also good supplies of locally grown feed such as barley.

Soil and Water Conservation

Fertility and Control.—Although as yet soil erosion is not a grave problem in the area, it will not be long before a serious danger point is reached unless farmers indulge in a more rigid system of ley farming. It cannot be said that the drive for extra food crops has resulted in a serious loss of soil fertility; indeed, with phosphatic manuring (which is now a general and accepted practice) and the ploughing in of crop residues on the poorer lands there appears to be a decided increase in fertility. The main danger of prolonged cultivation is arising from the breaking down of soil crumb structure into a fine or powdery dust which will erode with increasing rapidity.

During the year a Soil Conservation Service District Headquarters was established at Thomson's Falls. A commencement has been made with the terracing of arable lands, and the selection and survey of dam sites is now under way preparatory to a dam construction outfit coming to the district. (For further details, see the report of the Senior Soil Conservation Officer.)

Water Conservation and Improvement of Supplies.—During the year several excellent dams were constructed and many bore holes sunk. The scarcity of engines, pumps and piping has prevented the installation of many farm pumping outfits to take water from rivers and streams. It is being realized that a properly developed farm cannot rely on watering stock only at natural watering places.

The River Scouts have continued to carry out most difficult work in an excellent manner, and there is a gratifying rejuvenation of cover on valley slopes previously denuded by "squatters".

Destocking.—In the North Nyeri District a succession of abnormally dry years, followed by a severe drought in 1946, brought about a collapse of the grazing. During the dry years many farmers failed to limit their stock to the capacity of the grazing, and thus with the 1946 drought these overstocked farms found themselves with little or no reserve fodder or grazing. By the middle of the year the situation was becoming desperate, yet, against all advice, farmers held on hoping that rains would come to ease the situation. In September it became necessary to institute a vigorous destocking campaign and by the end of the year some 7,000 head of cattle had been removed from the worst areas. Many farms were destocked completely and sections of other farms were closed to grazing. Towards the end of the year the main area received good rains and protected areas began to show satisfactory signs of recovery.

Pasture Improvement.—Following a succession of dry years the Rift Valley benefited from excellent rains in 1946. Before the advent of the rains, even Star-grass had begun to die out. Since the rains grazing has shown great improvement and even though much of the cover is of the pioneer type, it is a welcome sight after months of practically bare ground.

In the higher mixed-farming areas the urgent demand for food (and the good prices prevailing for crops) has retarded the adoption of ley farming on a large or general scale. However, there is a decided response to the urge towards temporary leys; *Bromus marginatus* is becoming increasingly popular for a short term

pasture, and seed production both for home use and for sale has surpassed expectations; indeed, it is felt that the supply will more than meet present requirements.

Increasing and lively interest is being shown in the method of folding of both temporary leys and fodder oats as practised by Mr. J. M. Nightingale on the Kinangop. In the Naivasha area Mr. W. Hopcraft has carried out the contouring of pasture land with excellent results. The method employed was a simple one, consisting of marking out contours with a line level and ploughing terraces with a single furrow plough.

Pests and Diseases

Locusts.—Although several swarms invaded the area, no laying took place. Some damage was caused to young cereals, but crops recovered fairly well, and although there was a slightly reduced yield on isolated farms, the loss in grain was negligible over the whole area.

Crop Pests.—The Dusty Brown Beetle (*Dasus simplex*) has continued to cause damage to young cereals, and in some areas replanting was necessary.

Crop Diseases.—Cereal crops were remarkably free from both Stem and Yellow Rust, but *Fusarium* and Take-all appeared to be on the increase. A few outbreaks of *Fusarium* and *Sclerotinia* occurred on pyrethrum, and "Molo Bud Disease" was recorded from two farms in the Ol' Joro Orok area, although the incidence was negligible in comparison with the devastation caused in the Molo area.

Weeds.—Bindweed (*Polygonum convolvulus*) is increasing and becoming a menace in several cereal areas.

The Assistant Agricultural Officer reported a severe incidence of Stem Rust (*Puccinia graminis*) on Darnel, and although it is yet too early to say whether this will prove to be a factor which will help to control this weed, during 1946 at any rate it has reduced very considerably the formation of seed. Generally speaking, there was an appreciable reduction in the incidence of Darnel, especially in the heavier infested areas.

Cleavers (*Galium aparine*) has spread in many areas; to date the most effective form of control lies in cutting back both the cleavers and the young cereal crop before the latter pipes. This checks the weed and allows the corn to grow ahead of it.

Economic and General

The year has been a prosperous and successful one for the farming community; all branches of farming have paid good dividends and there is a genuine desire to utilize profits on development. This work is, however, seriously handicapped by lack of essential articles such as ironmongery, fencing wire, cement, tools, implements and building materials.

In an endeavour further to stimulate better farming methods, Farmers' Days have been organized on both farms and experiment stations. These have been well attended, and discussions showed a keen interest in the proceedings.

Greater control has been exercised over resident labour, and the three districts are enforcing their relevant rules under the Resident Labourers' Ordinance. A shortage of labour is still evident in many areas, and this has affected not only production, but also development. There has been a distinct leaning towards mechanization and labour saving devices; many farmers, for instance, are now considering the advisability of installing milking machines, while tractors have already largely ousted teams of working oxen.

Investigational

During the year the building programme was commenced at the Ol' Joro Orok Experiment Station and the following were almost completed:—

Three European houses, office, married quarters for Africans, and three blocks of labour lines. Work on the water supply was also commenced.

Grasses and Legumes for Pasture Leys.—Work has continued on these. In the higher rainfall areas *Bromus Marginatus* is giving excellent results. It was originally believed that this would only be successful on fairly good soils, but provided it is planted as early as possible in the season this grass has now been shown to grow well on the poorer land. *Beckeropsis* sp. has given disappointing results under field conditions; unlike *Bromus*, it is susceptible to frost, and although it is a quick grower, it does not appear to have lasting qualities. Work with this grass, however, continues, and an attempt is made to isolate and fix a leafy type as opposed to the less desirable stalky strains. Perennial ryegrass is proving of value on the Kinangop only, elsewhere it is poor and at the moment Italian rye is superior. These two grasses are being encouraged as a mixture with *Bromus*. Hubam clover has made good growth, but the Subterranean clovers have been disappointing; the growth of unirrigated lucernes (Provence, Hunters River, Hairy Peruvian and Siberian Cossack) has also been disappointing in the higher areas.

In the intermediate areas of lower rainfall where arable farming is marginal it has been extremely difficult to obtain a suitable ley grass. At the moment one of the most promising appears to be *Eragrostis curvula* and efforts are being made to bulk seed for more extensive field trials.

Improvement of Permanent Pasture.—The grazing trials at Rumuruti are proving the damaging effect caused to "Oat grass pasture", where this is grazed during the growing season each year. These trials are also showing in a very conclusive manner the need for adopting a "deferred" or "rotational" system of grazing in the pastoral areas and are demonstrating that unless this is done a deterioration of the pasture will result with a consequent reduction in the carrying capacity. On the other hand, the carrying capacity is being improved under sound pasture management. (See also 1945 Report.)

The Co-operative Experiments on Mr. E. H. G. Augeraud's farm on the Aberdares (8,300 ft.) continue to indicate the beneficial effect of burning in reducing the incidence of the most undesirable *Pennisetum schimperii* (wire grass) which is encroaching rapidly and seriously affecting the grazing in areas between 6,500 and 8,500 ft. with a rainfall of 27 inches to 33 inches. (See also 1945 Report.)

Wheat Trials.—In addition to No. 117A., four new and promising wheats were planted in two acre bulking plot on the Ol' Joro Orok Experiment Farm with the following results:—

Variety			Yield per acre		Days to Maturity
Regent	..	..	11½ bags	..	166
318.O.3.B.2	..	..	5½ bags	..	170*
294.M.7.C.6.A.	..	..	8 bags	..	163
294.B.2.A.3	..	..	9 bags	..	156
117.A.	..	..	8 bags	..	181

*Growth was retarded by locust attack when in seedling stage.

Wheat No. 117.A. lodged very badly, but Regent, 318.O.3.B.2 and 294.B.2.A.3 stood extremely well.

Control of Prickly Pear Cactus.—During the past few years this pest has spread in the warmer pastoral areas, and before it was agreed to import the parasite (*Cactoblastis cactorum*) from South Africa a cactus control experiment was carried out at Rumuruti. Plants were subjected to the following treatments:—

- (a) Dusting with D.N.O.C.
- (b) Spraying with 10 per cent aqueous solution of D.N.O.C.
- (c) Spraying with D.N.O.C. in oil.
- (d) Spraying with power paraffin.
- (e) Spraying with diesel oil.
- (f) Spraying with 5 per cent aqueous solution of sodium arsenite.
- (g) Injection of sodium arsenite powder in the basal joints.
- (h) Scorching with a flame thrower.

Neither (a) nor (b) had any appreciable effect upon the plants or their subsequent growth. Treatments (d) and (e) only delayed the production of new "leaves". No. (f) scorched the leaves but did not kill the plants, while (g) retarded the growth and killed some of the "branches". Apart from singeing the leaves, (h) had no effect upon the plants. The only effective treatment was (c), this began to react on the plants within three hours of application and within a week they had collapsed completely.

Weed Killer Trials.—The following are observations made on four sets of trials in the Thomson's Falls, Ol Kalou and Upper Gilgil areas. The material used was 1 per cent Methoxone dust, and applications made were at the rates of 100 lb., 200 lb. and 250 lb. per acre of the dust or 1 lb., 2 lb. and $2\frac{1}{2}$ lb. per acre of the active agent. Applications were made by passing the material through the fertilizer boxes of grain drills and the crops dusted were weedy cereals in all cases; they were treated at the end of July, 1946:—

- (a) *Kenya Charlock* (*Brassica sp.*).—This was in flower when dusted and was completely killed by the 100 lb. per acre dressing.
- (b) *Bindweed* (*Polygonum convolulus*).—Not affected, even at the 250 lb. per acre dressing.
- (c) *Cleavers* (*Galium aparine*).—Not affected.
- (d) *Pigweed* (*Amaranthus oleraceus*).—Leaves slightly affected by the 250 lb. per acre dressing only, but the plants recovered. In all cases this weed was perhaps too far advanced in growth, and it may be that younger plants would be seriously affected.
- (e) *Mexican Marigold*.—Results were similar to those for pigweed (d) above.
- (f) *Giant Nettle* (*Urtica sp.*).—Leaves affected and stems appear to be dying but rootstocks still appear to be healthy.
- (g) *Spurrey* (*Spergula arvensis*).—Not affected.

The cereals themselves were not affected by the Methoxone dust.

Bush Control.—A 2 per cent solution of Methoxone was sprayed over thorn bush and *Euclea lanceolata* and the solution was also applied to cuts in the bark. The first treatment had no effect other than to defoliate the trees while the second had no visible effect at all.

Destruction of Harvester Ants.—In many parts of the pastoral areas Harvester ants continue to damage the grazing considerably. An endeavour has been made

to destroy the nests, in a practical way, with various concentrations of the following poisons, but although they cause a temporary lull the nests become active again within a few weeks:—

Potassium cyanide, pyrethrum powder, pyrethrum extract, D.D.T. Gammexane (666), paraffin, petroleum and arsenite of soda. Poison baits were also used with but little success.

A further and more complicated experiment, using Gammexane was started near Gilgil towards the end of the year.

Fertilizers.—No statistical experiments were laid down in 1946, but six field trials of silicophosphate were carried out, and in each case the beneficial effect of the application (made at about 140 lb. per acre) was most marked.

Pyrethrum.—The pyrethrum work commenced at Ol Joro Orok in 1945 has continued and, in addition to further selection work, a pyrethrum rotation experiment has been started (*see* also the 1946 Reports of the Senior Plant Breeder and the Agricultural Officer, Pyrethrum Services).

Potatoes.—The following varieties of “blight resisting” potatoes were planted at Ol Joro Orok Experiment Station during the April rains:—

No. 914	..	..	..	..	..	Dutch Robyjin.
No. 931	..	..	..	..	..	Salaman-Clarke 1.
No. 655	..	..	..	..	..	Salaman-Clarke 2.
No. 653	..	..	..	..	..	Salaman-Clarke 3.
No. 833	..	..	..	..	..	Salaman-Clarke 4.
No. 834	..	..	..	..	..	Salaman 1.
No. 835	..	..	..	..	..	Salaman 2.
No. 855	..	..	..	..	..	Reddick 18.

of the above No. 914 and Dutch Robyjin were outstandingly good. No. 914 which was growing next to Craigs Defiance appeared totally resistant to blight in spite of the fact that the latter was completely destroyed by this disease. Other promising varieties were No. 835 Salaman-Clarke 2 and Salaman-Clark 1.

The crop from No. 914 and Dutch Robyjin were ripened after lifting and replanted again in the October rains on a farm on the Aberdares for bulking purposes. Here No. 914 grew excellently, but Dutch Robyjin had a slight infestation of blight. Seed of No. 914, Dutch Robyjin, No. 835 and Salaman-Clarke 2 (from the Scott Agricultural Laboratories) was also planted for bulking purposes on two farms on the Kinangop in September.

It is hoped to get the best of these varieties into commercial use in 1947.

Advisory and Routine Work

The advisory services continue to extend and some 780 visits were made to farms in connexion with general farming problems and planning. Work connected with the Increased Production of Crops Ordinance has not been so heavy as in past years; nevertheless, it continues to occupy a large proportion of time.

Conclusion

The assistance and co-operation of farmers and especially that given by Chairmen and members of Production Sub-Committees and Honorary River Wardens is gratefully acknowledged.

T. Y. WATSON,
Senior Agricultural Officer, Rumuruti.

ANNUAL REPORT OF THE SENIOR SOIL CONSERVATION OFFICER, 1946

Staff

European.

Mr. R. O. Barnes, Soil Conservation Engineer, was absent on overseas leave from 26th September, 1946, until the end of the year.

Mr. C. F. Newton, Assistant Soil Conservation Officer in Charge, Nakuru District, was absent on overseas leave from 2nd July to 21st December, 1946.

During the year a number of additions were made to the European staff, including three officers on the Mechanical Staff; two Stenographers; one Accountant/Office Superintendent and twenty-five Assistant Soil Conservation Officers, Grade I, making a total of thirty-four Assistant Soil Conservation Officers Grade I and two Grade II. A number of these officers were recruited by the African Settlement Board, but as they were all placed in a common pool, the officers recruited by the Soil Conservation Service direct and by the African Settlement Board were seconded indifferently to schemes in the Native Reserves.

Mrs. A. L. Williamson was transferred to the head office of the Agricultural Department on 10th August, after five years of most conscientious and loyal service with the Soil Conservation Service.

The following officers were in charge of Soil Conservation Service District Headquarters:—

Trans Nzoia.—Mr. J. H. Midgley: From 1st January to 2nd August. Mr. J. L. Wordsworth: From 3rd August to 13th November. Mr. M. Kerfoot: From 14th November to end of year.

Uasin Gishu.—Mr. G. E. Goby: From 20th May to end of year.

Nyanza Province.—Mr. N. G. Glynn: From 1st January to 30th March. Mr. S. S. Brugh: From 8th August to end of year.

Nakuru.—Mr. C. F. Newton: From 1st January to 2nd July. Mr. G. D. M. Bailly: From 3rd July to 21st December. Mr. C. F. Newton: From 22nd December to end of year.

Thomson's Falls.—Mr. N. G. Glynn: From 8th April to end of year.

African.

During the year there was a continued shortage of levellers, and there were only 23 levellers and 12 learner levellers on strength at the end of the year. The work of the African staff was well up to standard during the year and there were no major troubles, except for faint repercussions from the misunderstood speech of the Labour Commissioner regarding the terms of service of African labourers. During the year the number of labourers was increased to 180 in order to obtain a number of labour gangs for work on farms on which farm labour was short. It was found that these migratory gang labourers, who were paid Sh. 5 a month more than the labourers resident in camp, on the whole worked satisfactorily with adequate supervision, and improved in health and physique with the supply of full Government rations and regular hard labour.

The staff of the Soil Conservation Service were gratified at the award in the Birthday Honours List of the B.E.M. to Mr. Onesmus Musuyoki Mutisya, head leveller of the Soil Conservation Service in the Trans Nzoia, in recognition of his conscientious work and devotion to duty.

During the year the African staff formed a Soil Conservation Service African Staff Club, which discusses matters affecting the welfare of African staff and the Committee of which acts as liaison for such matters between the European

officers and general African staff. The operation of the library was taken over by the club and a number of illustrated and other periodicals—in English—are taken for circulation amongst African staff. A football team was run throughout the year at Kitale and the Soil Conservation Service ground was in much demand by African teams in the district. Soil Conservation Service football teams were occasionally raised at Njoro and Thomson's Falls.

Visits

The Officer in Charge made various visits to Thomson's Falls and Lumbwa areas in connexion with the establishment of Soil Conservation Service District Headquarters for Laikipia and Nyanza Province European areas respectively. On 12th April he addressed the Rotary Club in Nairobi on "The Place of the African in the Economic Life of the Colony". During the week commencing 9th June, Mr. Maher attended the Senior Agricultural Officers' Conference in Nairobi. A visit was paid to the Kamasia Reserve early in October in company with Miss C. L. Frazer, Assistant Soil Conservation Officer (Botanist), to examine the condition of the grazing and to inspect the progress of the new grazing schemes, which will be mentioned later.

Numerous visits were paid to the Uasin Gishu District, as well as to the Thomson's Falls area, to examine dam sites, and in November a visit was made with Miss Frazer and Mr. E. J. Darvall (mechanical staff) to Mr. Gilbert Colville's estate, Ndabibi, at Naivasha, to inspect Mr. Colville's D.7 Caterpillar Tractor and machine for uprooting Muleishwa (*Tarchonanthus camphoratus*).

During December a visit was made to North Kinangop and a talk on drainage, etc., was given by Mr. Maher to the North Kinangop Farmers' Association.

During the year Mr. Barnes visited Kitale with reference to the Holmboe drainage scheme at Endebess. Thomson's Falls and Ol' Joro Orok were visited with reference to terracing layouts, drainage schemes and dam sites, and Lumbwa in reference to water supply for the new Soil Conservation Service District Headquarters.

Visitors

His Excellency the Acting Governor, Mr. G. M. Rennie, visited Kitale from 23rd to 28th January together with his Private Secretary and Secretary to D.A.R.A. (Mr. J. Howes). He visited numerous farms in the company of the Officer in Charge, Soil Conservation Service, and saw work at the new Agricultural Department Training Farm at South Elgon and the Agricultural Experimental Station.

A party of Wakamba, including two chiefs, two agricultural instructors, and ten Chairmen of Agricultural Committees, accompanied by Mr. G. Beverley, assistant soil conservation officer, Machakos, visited Nakuru and Kitale from 29th January to 6th February. At Nakuru the party was accompanied by Mr. R. O. Barnes, the soil engineer. They inspected the Agricultural Experimental Station, the Agricultural Training Farm (South Elgon), the Kitale Prison Farm and examined soil conservation work, dam construction and animal husbandry on a number of farms in the Uasin Gishu and Trans Nzoia Districts in the company of Mr. Maher. The party was accompanied and demonstrated to at the first two places by the Senior Agricultural Officer, Kitale, who also came with the party to several of the farms visited.

Colonel Evans, consulting engineer, of D.A.R.A., visited Kitale from 23rd to 25th September and in company with the Officer in Charge, Soil Conservation Service, inspected soil conservation work on various farms in the district and at the Soil Conservation Camp, Kitale, and the new offices and African quarters in course of construction at Kitale.

Terracing and Associated Works

The following table summarizes the work carried out during the year in the European areas of the Colony:—

TABLE I
TERRACING

	BROAD BASE			NARROW BASE		
	Acres	Miles	No. of Farms	Acres	Miles	No. of Farms
Nakuru	4,207.9	380.3	44	252.4	36.3	11
Uasin Gishu ...	831.3	93.04	29	3.0	.5	1
Trans Nzoia ..	1,324.3	132.99	28	82.2	16.7	7
Thomson's Falls	158.5	20.52	3	—	—	—
Nyanza	770.6	102.99	10	—	—	—
TOTAL ..	7,292.6	729.84	114	337.6	53.5	19

TABLE II
MISCELLANEOUS WORK

	Hand-work Cu. ft. Ex- cavated	Length of Outlet Drains Con- structed	Length of Cut-off Drains Con- structed	Length of Roads Con- structed	Acreage Bench Terraced	Length of Road Repaired
		<i>Yds.</i>	<i>Yds.</i>	<i>Yds.</i>	<i>Acres</i>	<i>Yds.</i>
Nakuru	180,071	30,445	15,630	34,893	—	—
Uasin Gishu ..	255,417	8,517	13,045	—	13	12,320 (Graded for a Saw Mill)
Trans Nzoia ..	329,124	24,061	10,335	25,462	28.5	—
Thomson's Falls	77,300	—	—	—	—	—
Nyanza	97,186	2,960	11,088	—	—	—
TOTAL ..	939,098	65,983	50,098	60,355	41.5	12,320

Machinery

Apart from the machinery for the Dam Construction Unit, which will be mentioned separately, the following additions were made to the machinery of the Soil Conservation Service during the year:—

One T.D. International Tractor: Purchased from the Machinery Pool (second-hand) in January.

One D.6 Caterpillar Tractor: Delivered in March for work in the Uasin Gishu District.

One No. 2 Caterpillar Terracer: From The Masai Wheatlands (purchased from the Agricultural Production Board) in April.

One No. 2 Caterpillar Terracer: Purchased from Suam Saw Mills in October.

The Caterpillar 28 Tractor, which is mentioned in the 1945 Report as suffering from many breakdowns, was finally decided to be unserviceable in March and was not used again. At the end of the year there were three D.6 Caterpillar Diesel Tractors available for work in the field at Lumbwa, Nakuru and Eldoret and a T.D.14 at Kitale. In addition, a 28 and 25 Caterpillar Tractor (paraffin) were on hire from the Machinery Pool for work at Thomson's Falls.

Vehicles

During the year the following additions were made to the vehicles in use by the Soil Conservation Service:—

One 1-ton Ford ex-Agricultural Department.

Five 3-ton Lorries, ex-Army, second-hand (2 Chevrolets, 2 Dodges and 1 Ford).

One Dodge—15 cwt.

One Dodge—10 cwt.

Two Fords G.8.T. (6-cylinders).

Nine new Ford V.8's. Light Delivery Vans (received during the year and distributed to the various stations).

Drainage

The survey of the Rongai Valley drainage scheme was completed in the first week in February. Farm blue prints were issued to the 70 or 80 farmers in the district as far as printing paper was available and arrangements made to keep the chosen drainage lines permanently under grass. The Soil Conservation Engineer gave index numbers to the drainage lines to be used for disposal of run-off water from terraced areas and prepared a key map for future reference.

Open ditches on the Holmboe Drainage Scheme at Endebess were completed on 31st March. Sub-laterals were constructed about 35 yards apart in the direction of the main slope, on grades which varied from 0.25 per cent to 0.5 per cent. These sub-laterals drain into the cross drains on 0.25 per cent grades which, in turn, lead into the two main drains. A small area of two to three acres was mole-drained into a tiled main. The main for this small experimental area was tiled with Roman tiles, used in pairs and telescoped together. The Holmboe Drainage Scheme did not give optimum results, owing to failure to remove ant hills and other obstructions in the sub-laterals. Results, however, were remarkable, and it is hoped that the area of 300 acres, which gave one bag of maize to the acre, will be producing 15 bags per acre during the next year or two. During July and August the larger of the two main drains carried a flow of more than 300 cusecs, some of which was drainage water off the field itself, while some was run-off water received from the farms above.

Levels were taken in 100 feet squares on an area of 250 acres on a farm near Kitale and a topographic map with 6-inch contours was prepared as a basis for preparing a scheme for the draining of this area of heavy clay, under pasture, in the Koitobos flood plain. The maximum grade of this area is only 1 in 500.

During February the Italian Survey Party (Lieut. Fingo and Lieut. Iraci) completed a survey of about 310 acres on Mr. North's farm near Thomson's Falls, which is to be mole-drained by the Soil Conservation Service during 1947. A topographic survey was also made by the Italian Survey Party of the new Agricultural Experimental Station at Ol' Joro Orok, including a vlel which is to be drained by the Soil Conservation Service.

African levellers from Thomson's Falls made a plane table contour survey towards the end of the year of 50 acres on the North Kinangop, which is to be mole-drained later on.

Keen interest was shown by farmers in several districts during the year in the prospect of the Soil Conservation Service carrying out extended operations in the way of drainage. Unfortunately, the number of tractors at the disposal of the Service is so limited that at present it is not possible to do as much work of this nature as is desirable in the interest of crop production in this Colony.

During his leave, Mr. R. O. Barnes spent some time in studying drainage methods in several parts of England, and it is hoped that the knowledge which he has thus gained will be of the greatest value to the Soil Conservation Service in the future.

Water Supplies

During April the dam in the South-West Trans Nzoia was completed by means of a hired D.6 Tractor and Angledozer. This dam has a fill of about 3,000 cubic yards and a capacity of about $1\frac{1}{2}$ million gallons. The dam at Karuna, Moiben, filled up to its full capacity of 27 million gallons during July and August and there was some flow out of the major spillway. In July three Caterpillar D.7 Tractors were received together with two 10-yard Le Tourneau Carryall Scrapers, three Le Tourneau Angledozers and three Killifer Rooters (of which the smaller was adapted for mole drainage).

Following the training of staff in the use of these machines on a large sports ground in the Kitale Government School, involving the moving of over 10,000 cubic yards of earth, and of a hockey ground for the Kitale Sports Club, for which 4,300 cubic yards of earth was moved, a start was begun on dam construction on farms. Five dams were completed by the end of the year, details of which are given in Table III. Detailed costs are being kept during the construction of these dams. In the initial stages of the programme charges were made which were based merely on actual machine costs, plus 10 per cent towards overheads. In view of the considerable value of the capital assets which are provided on farms by the construction of good dams, it has been decided that in future full costs will be charged to the farmer, including the costs of European supervision, transport, etc. There is a strong demand from farmers for the provision of these water supplies for stock, domestic purposes and minor irrigation in a number of districts, and the Dam Construction Unit is booked up for many months ahead. Most of these dams necessitate a fill of between 3,000 and 15,000 cubic yards.

TABLE III
DAMS COMPLETED DURING 1946

NAME OF OWNER	Cubic Yards Fill	Capacity	Catch- ment Area	Spill- way Capacity	Purpose
		<i>Acre ft.</i>	<i>Acres</i>	<i>Cusecs.</i>	
G. K. Irwin, Hoey's {	4,036	4.5	47	180	} Minor irrigation Seed Production.
Bridge ..	6,450	13.0	145	300	
Mrs. Bowering, Cheran- gani	1,300	3.0	185	350	Stock.
D. P. J. Englebrecht, Moiben Valley ..	14,900	55.25	5,000	2,000 (1,500 & 500)	Stock.
A. Wright, Moiben ..	5,000	28.55	2,000	1,200 (1,000 & 200)	Domestic and Stock.

During the year the Soil Conservation Service Engineer continued to consult with the Road Construction Engineer of the Public Works Department with regard to necessary works to protect the Kijabe section of the new Nairobi-Nakuru trunk road. Works which were constructed on the advice of the Soil Conservation Engineer were found to function satisfactorily when the heavy rains began.

It will be noticed from the schedule of miscellaneous work that in connexion with Soil Conservation Service schemes, nearly 35 miles of farm roads were constructed by the Service during the year.

Surveys

In addition to the surveys made in connexion with drainage schemes, a good deal of work was done in respect of miscellaneous land use surveys. At the beginning of the year, the Soil Conservation Engineer plotted a map from aerial photographs of the Matungulu area of the Machakos Reserve, showing the arable areas. Two European officers of the Soil Conservation Service made a topographic survey of approximately 150 acres of land near Kapenguria, from which 90 acres is to be set aside for an Agricultural Training School. The Italian Survey Party, whose services were lost owing to repatriation during the third quarter, completed a survey with 5 ft. contours of 288 acres of Crown Land and 152 acres of Township Land included in the Soil Conservation Service plot in Kitale Township. African levellers completed a plane table survey of 480 acres near Thomson's Falls and of two areas totalling 600 acres on a farm at Ol' Kalou.

Refresher Course

Twenty-six Assistant Soil Conservation Officers and three Senior African Levellers attended a short training course at Kitale District Headquarters from 1st July to 3rd August. Lectures and practical demonstrations were given by the Officer in Charge, Soil Conservation Service, and by the Soil Conservation Engineer.

Native Reserves

At the beginning of the year the Soil Conservation Engineer took part in a number of reconnaissances made for the purpose of picking out betterment areas in the Machakos Reserve and also attended several conferences at which methods of mapping and photographing areas were discussed.

On the completion of the training course on 3rd August, several officers were seconded for work on certain development and rehabilitation schemes in Native Reserves:—

Ndalat Grazing Scheme.—Mr. M. Sholto Douglas, B.A. (Cantab), was seconded as Executive Officer for this scheme on 20th August, 1946. The Ndalat area comprises 9,000 acres in the Nandi Reserve, which is being fenced as a unit and sub-divided to allow of rotational grazing, while arable areas are to be protected by appropriate conservation measures. After initial difficulties, due to the reluctance of the local young Nandi tribesmen to put in the necessary labour, good results were obtained by Mr. Douglas, and it is hoped that an increasing amount of appreciation of the benefits of this scheme will be shown by the Nandi people and that they will desire the extension of this type of work in their Reserve. Dipping is carried out compulsorily in this area and numbers of stock have been brought forward for sale at voluntary stock sales on this and neighbouring areas of the Nandi Reserve—though it is doubted that the rate of disposal of stock, even so, is sufficient to curb the natural increase.

Kamasia Reserve.—Two grazing schemes are in operation in the Kamasia Reserve—one consists of about 50,000 acres in the Esageri and old Roughcastles near Sabatia. Mr. R. A. Langridge, M.C., Assistant Soil Conservation Officer, was seconded for work at Esageri at the end of July. Mr. Langridge began clearing bush in the Kisikon area and 300 acres had been stumped by the end of the year. On 250 acres of this contour lines of bush were placed every 50 yards and a 50-foot strip of bush left as a windbreak every 250 yards. Good grazing grasses such as *Cynodon* spp., *Hyparrhenia* spp. are reported to have increased in the cleared areas at the expense of the poor annual species, such as the *Aristida* spp., *Chloris pycnothrix*, etc. Some six and a half miles of bush fencing was also erected between the Kamasia Reserve and the Esageri farms and on the Kisikon border. Mr. Langridge considers, however, that a patrolled wire fence will ultimately be necessary to prevent poaching of protected grazing by the Kamasia. Mr. Colin Maher, Senior Soil Conservation Officer in Charge, Soil Conservation Service, joined the provincial planning team for the Rift Valley (including the Nandi, West Suk, Kamasia and Samburu Reserves) on 30th September at the request of the Provincial Commissioner, Rift Valley Province.

The second grazing scheme was in the location of Pokorr and Enderois in South Kamasia on the Solai border. Mr. W. M. Spencer was posted to this area to supervise fencing on about 9,000 acres to facilitate rotational management. It was evident early on that there would be considerable difficulty in this district, which is relatively densely populated in relation to the rainfall and grazing possibilities, in preventing damage to fences and poaching by local Kamasia tribesmen. These are matters which will have to be dealt with firmly in the future if the expenditure of money in this area is to have beneficial results.

Inspection Service

With the increase of staff during the year, it was possible to post officers for duty as inspectors as follows:—

Mr. J. H. Midgley: On 3-8-46 to Trans Nzoia District at Kitale.

Mr. R. L. Huntingford: On 8-8-46 to Uasin Gishu District at Kaptagat.

Mr. J. G. Freeguard: On 4-8-46 to Nakuru District at Njoro.

Mr. R. E. G. Ruck: On 4-8-46 to Nyeri District and Nanyuki at Lamuria.

Mr. I. G. Brown: On 4-8-46 to Thika District and parts of Kiambu Reserve at Thika.

In the ordinary course of work officers of the Soil Conservation Service find their attention has to be concentrated on certain farms on which work is in progress, while even agricultural officers do not have the opportunity of seeing every farm in a large district. The provision of these inspectors has enabled attention to be focused on farms on which soil fertility is deteriorating markedly and in some cases is causing a permanent loss of fertility. Following inspection and the submission of reports to the Senior Agricultural Officers, certain deteriorating arable lands have been restored to pasture, while other fields have been earmarked for terracing at the first possible date. Inspectors have been able to support and give closer control to river scouts and valuable work has been done in the safeguarding of river banks and the preventing of pollution to rivers.

The inspector stationed at Lamuria in September at once embarked on action to control the rate of stocking on drought-stricken farms in the Laikipia, Nanyuki and North Kenya areas. Some 7,000 head were removed from farms apart from the normal sales of finished steers. Mr. Ruck also took action in co-operation with the squatter inspector in reducing the number of squatter stock on the farms on the foothills of the Aberdares.

River Scouts

The river scouts in European areas did good work throughout the year, and in several districts their work was commented upon with high favour. It is realized that while restrictions on the individual may cause individual inconvenience, these restrictions are of general benefit to the community.

Soil Conservation District Headquarters

During the year 30 acres were set aside for a District Headquarters for Nyanza Province European areas at Lumbwa. Some temporary buildings were erected for the accommodation of African staff.

Twenty-three and a half acres were set aside at Thomson's Falls for the District Headquarters, Laikipia area, and at this station two store buildings were completed and a five-roomed block of offices, in timber, was almost completed at the end of the year. Seven temporary timber huts with shingle or rubberoid roofs were also erected at Thomson's Falls, while at Kitale the number of temporary mud and wattle huts was raised to 62. At Kitale a six-roomed block of offices, together with lavatories and sanitary convenience was designed by M. Giovanni Fedrigotti, who had also designed the Thomson's Falls offices, and construction was begun under his direction and had reached an advanced stage before he was called for repatriation in August. Work on these offices was held up considerably owing to lack of certain essential building materials, but it is hoped that they will be completed by the end of the first quarter of 1947. A large housing block in brick was also nearly completed during the year, which will provide accommodation for about 15 African families, and includes a common dining room, kitchens, bedrooms, shower baths, laundry and water-borne sanitation. This also was designed and partly supervised by M. Fedrigotti.

During the year negotiations proceeded for the purchase of 150 acres of land near Nakuru for Nakuru District Soil Conservation Service Headquarters and for Soil Conservation Service General Headquarters. It was considered that Nakuru would give a more central station for operations in various parts of the European and Native areas of the Colony, while it is now within easy reach of Nairobi on the new tarmac road.

The European Settlement Board was approached for the sale of some 70 acres for the Uasin Gishu District Headquarters near Eldoret, but these proposals had not been concluded by the end of the year.

Attention was concentrated during the year on the provision of District Headquarters, but an area of 500 acres of Crown Land in the South Kinangop District was provisionally reserved for a training school for Soil Conservation Service staff.

It was decided towards the end of the year that the Public Works Department should carry out the building programme for the Soil Conservation Service District Headquarters, including European and African housing and the remaining offices and stores. However, it is likely that accommodation will be required for approximately 700 Africans, and it may be some time before the Public Works Department will be able to provide sufficient permanent buildings. It was decided, therefore, to ask for funds for the construction of 260 semi-permanent rooms, in pairs, of timber. These will be distributed amongst the five District Headquarters.

Health

At the end of March the Public Works Department completed the supply of water from the town water supply to the Soil Conservation Service camp at

Kitale. This good supply of fresh water was much appreciated by the African staff and their families. It has been possible to provide a small number of shower baths.

Throughout the year it was necessary to take great care to prevent the breeding of mosquitoes in the vicinity of the Soil Conservation Service camp at Kitale, but it is feared that there is an ingression of mosquitoes from old brick fields near the camp, but outside the land controlled by the Soil Conservation Service.

Arrangements were made to enlarge the vegetable gardens to two acres in order to provide a better supply of vegetables for African staff.

Soil Conservation in Grassland

The utilization and preservation of the grazing lands of the Colony are perhaps the most important questions connected with the preservation of the natural resources of the Colony. The problem of soil conservation, on its technical side, in the Ukamba Reserve, for example, is one of grassland management in at least 90 per cent of the area.

Certain mechanical work has been done by the Soil Conservation Service for several years in the way of making contour furrows or contour banks to reclaim or improve deteriorated grassland. The ecological aspect required, it was realized, additional attention, however.

For many years it has been desired to obtain a qualified officer with the Soil Conservation Service, who could study the ecological relationships of the grasses, trees and bushes and herbs in land which is deteriorating compared with those on land which is being conserved, and who could examine methods of grassland management which affect the question of procuring the best land use and of preventing deterioration of the vegetation, both in quality and quantity. These tasks would necessitate studies in the field, the maintenance of trial plots, experimental grazing areas and the collection of a large reference herbarium. In addition, a study could be made of weeds affecting crops and training given to new officers in the recognition of grasses and in grassland management.

On 12th September Miss C. L. Frazer, B.Sc. (Manchester), who had specialized in botany, was appointed as Assistant Soil Conservation Officer with special duties, as described above. During the remainder of the year, Miss Frazer, who was stationed with the Soil Conservation Service Headquarters at Kitale, made visits to Kamasia, Ndalat, the Uasin Gishu District, the Laikipia District and elsewhere to study the grasslands. By the end of the year Miss Frazer had built up an herbarium at Soil Conservation Service Headquarters with 130 specimens of indigenous grasses.

For some years the various types of fodder trees and shrubs have been investigated by the Soil Conservation Service, while grasses for drought-stricken and deteriorated areas have been under trial following receipt of seed of various grasses from friends in the Soil Conservation Service in Arizona. These trial plots and the bulking at the Soil Conservation Service camp of seed of varieties deemed worthy of grazing trials have been placed in the hands of Miss Frazer.

Unfortunately, the rainfall in Kitale is too high to be suitable for the trial of all species and perhaps for their optimum growth and insufficient seed has been bulked for trial in other districts as yet. The three species of *Eragrostis* appear to be of value, and a report has been received from the inspector in the North Nyeri area stating that *Eragrostis curvula* shows considerable promise for the

drier districts. He suggests trying the method reported from the U.S.A. to have been successful, in which the seed is rolled in pellets of treated soil. A machine is necessary for preparation of the seed and this might be obtained later.

From the experimental ungrazed plots at Kitale the following observations have been made:—

1. *Eragrostis curvula*.—Plants grown from seed planted in August, 1946, seeded in December, 1946. The seeding was moderately heavy. This South African grass is well reported upon from the drier parts of the U.S.A., and might be a good grazing grass in Kenya if grazed down to form a sward, otherwise it is clumpy, but it keeps green all the year. The leaves are hard and narrow, typically xerophytic, and may not be liked by cattle. It is intended to plant this grass in 1947 for grazing tests.

2. *Eragrostis lehmanniana*.—Plants grown from seed planted in August, 1946, seeded in December, 1946. It would be even better than *Eragrostis curvula* if grown from seed broadcast heavily. It appears to give good grazing and seeds very heavily, but it is not such a good stop-wash on account of the shallower roots.

3. *Eragrostis chloromelas*.—Plants grown from seed planted in August, 1946, seeded in December, 1946. It appears to give very good grazing if a heavy sowing is made and the grass kept down to a sward by heavy grazing. Otherwise it is clumpy.

These three species of *Eragrostis* seem to have great possibilities in this country. The only trouble is their clumpy nature, which might be overcome by grazing down to a sward. All three seed heavily and will grow from seed as successfully as from splits. They produce much leaf which stays green all the year in this district. *Eragrostis curvula* appears to be the best type for semi-arid areas and makes a good soil-holder.

Digitaria swazilandensis.—This is a very good grass for planting ditches and drains, forming a close sward and a good soil protection with no bare ground showing. It dries out early and does not appear to be a good grazing grass.

Brachiaria dictyoneura.—An excellent indigenous grass for ditches and drains. It forms a close sward and a very good ground cover. It spreads rapidly by creeping stems rooting at the nodes. It has a broad leaf which would make good grazing, but it is frequently infected with a fungus causing leaf-spot. It does not grow well from seed.

Panicum antidotale.—This is a grass with possibilities for hay. It is not a prolific seeder and might not get a chance to produce much if used as a grazing grass.

The above-mentioned grasses are those which have definite possibilities in this country. The following grasses need further trials in different climatic areas before they can be either rejected or reported as useful:—

Bouteloua rothrockii.—Failed.

Bouteloua filiformis.—Very poor.

Bouteloua curtipendula.—Poor.

These American grama-grasses do not seem to be much of a success in this district. If a heavy seeding could be made, a sward might be established. It is proposed to send seed to a drier area for trial.

Setaria machrostachya.—Not very satisfactory. It is rather clumpy and does not spread much, but has a good leaf. Close sowing in a drier area is needed.

Astrebala lappacea.—Of no value in this district, but might do better in a drier area. It has not spread or seeded to any extent.

Muhlenbergia porteri.—A failure in this district, but its poor showing may be due in part to being eaten severely by buck early in its growth.

Sporobolus cryptandrus.—Gives good grazing early, but dries up too soon to be of any value in this district. It is unlikely to be of use as a grazing grass in any district.

Trichachne californica.—Of no value in this district. Apparently suited to a drier climate.

Paspalum notatum.—This is a low grazing *Paspalum* sp. derived from the Argentine. It is much used for the protection of banks, channels, edges of bench terraces, etc., in Uganda and has been found most useful for similar purposes in the moister, warmer parts of Kenya. In Uganda it is said to be a good grazing grass. It grows rather slowly at altitudes over 7,000 feet. It is a running grass, but not a pernicious and fast runner and can easily be kept under control; nor does it tend to enter into the land or invade bench terraces in the manner of Kikuyu grass or the *Cynodon* spp.

Panicum makarikariensis.—This coarse but palatable running grass from South Africa grows well on poor and eroded soils in the Trans Nzoia. A larger plot is to be planted for grazing trials at the Soil Conservation Service Camp, Kitale. It may be planted by either seed or cuttings and may prove to be useful on old eroded maize lands which are to go back to grass.

General

In 1946 for the first time since the Soil Conservation Service was formed at the beginning of 1938, the European staff was increased considerably. Four difficulties became very evident during the year as a consequence: lack of training facilities and training staff, lack of instruments, lack of machinery and lack of the higher grades of African subordinate staff. The short one month's course which was attended by 26 officers in July was helpful, but a much longer course—of at least six months and possibly a year—is obviously needed, in a school devoted exclusively to this task; further, a number of officers joined the Service after the course was over.

More instruments are on order, but there seems little likelihood that further heavy tractors and machinery will be available for a considerable time, owing to the post-war labour troubles and the general disruption of industry caused by the war.

The lack of secondary educated Africans in sufficient numbers for training as levellers has also been a bottle-neck, which it is likely will remain until the educational facilities of the Colony are enlarged considerably.

Despite the increase in European staff the number of officers available was still entirely inadequate for work which continually increases in quantity and broadens in scope. Owing to the delays enforced by the war, there is strong pressure now to supply officers immediately for work in the Reserves. These officers have received, however, little or no training for their work. In the European areas the demand for terracing and other works is so persistent that there is a tendency to carry out works on individual fields without consideration of the whole farm programme. The use of voluntary agreements with the farmers only partially corrects this fault. Farm planning in the U.S.A. on the average farm of 100 acres is child's play compared with planning on farms of 1,200 acres or more, which are common in Kenya Colony; but for the task of planning of each farm by District Officers of the Soil Conservation Service of the United

States Department of Agriculture there is usually a team of four or five men, including a surveyor, agronomist, engineer and soil conservationist, working in most cases with the aid of a contour map which is frequently based on aerial photography.

In Kenya Colony contour maps are either non-existent or show insufficient detail for the planning of land for optimum use, soil conservation or drainage. The Italian survey team was able to do valuable work in making contour surveys of large drainage and other projects but, with their repatriation, the Soil Conservation Service now does not have a team of trained surveyors for such essential work preliminary to planning.

The Soil Conservation Service still awaits qualified engineers to assist the Soil Conservation Service Engineer. It is likely to be long before there are enough well trained agriculturists; and while, given time and facilities, it would be possible to train men for survey work, the existing proposals for staff to be posted in European districts—which have been framed in accordance with estimates for expenditure of the Development Funds—do not allow of seconding men for preliminary land use mapping, which is apt to be a somewhat slow task on the large units which have to be dealt with. Similarly, with the exception of certain maps made by Italian surveyors at Ndalat, in the Nandi Reserve and in parts of the Kamasia Reserve, there are as a rule maps of insufficient detail to be used as a basis for land use plans in the Native Reserves. There is a strong tendency for schemes to be pressed forward, indeed not only with insufficient detail regarding topography, soils and vegetation, but also with inadequate precision regarding sociological and economic actualities and aims. Here again, it is plain that many more *trained* officers are needed in the field to secure the fundamental facts regarding land and people *before* plans can be devised and put into action. The seconding of half-trained or untrained officers as executive officers for schemes in the Native Reserves of which the aims are indefinite and far too generalized can only be regarded with apprehension, and strong doubts must be felt as to the ultimate benefit to be derived from the expenditure of large sums of money in such cases.

It is true that land use planning is a relatively new concept and that development in the past has been largely left to the unco-ordinated, uncorrelated efforts of private individuals. Situations of disequilibrium have been righted by outbreaks of disease, by famines and by wars, associated with migrations and exterminations. In the more closely knit and inter-dependent world of to-day, with its swift means of communication and its even swifter means of destruction, this is rendered impossible, however. We have planned for death only too successfully. We must now learn to plan for life, meticulously, wisely and comprehensively, or lands will decay and the people vanish.

COLIN MAHER,
Officer in Charge.

ANNUAL REPORT OF THE SENIOR COFFEE OFFICER, 1946

Staff

Mr. Gillett continued as Officer i/c Coffee Services throughout the year, although for most of this period he was also Acting Deputy Director of Agriculture and could consequently only devote a limited amount of his time to coffee matters. Mr. Cottington and Mr. Schouten remained at Ruiru and Kitale respectively. Mr. Melville proceeded on leave to the United Kingdom in April, and was absent from his station for the remainder of the year. Mr. Rayner continued his work at the Scott Agricultural Laboratories and was joined by Dr. Pereira, who arrived in the Colony in June, on first appointment, as Agricultural Chemist, Coffee Services. Mr. Blackburne was appointed an Assistant Agricultural Officer in June, and was posted to the Coffee Research Station, Ruiru, to assist Mr. Cottington.

The actual staff position at the end of the year was as follows:—

Officer in Charge.—Mr. S. Gillett.

Agricultural Officer.—Vacant.

Entomologist.—Mr. A. R. Melville.

Plant Pathologist/Physiologist.—Mr. R. W. Rayner.

Chemist.—Dr. H. C. Pereira.

Senior Assistant Agricultural Officer.—Mr. E. Cottington.

Three Assistant Agricultural Officers.—Messrs. Schouten, Hewitt and Blackburne.

Field Assistant.—Vacant.

Junior Laboratory Assistant.—Mr. C. W. Shorman.

Mention must again be made of the services rendered by the trained African staff, especially the two African laboratory assistants on the entomological side, whose work has been of a high standard with a minimum of supervision.

Coffee Research Committee

This Committee met on four occasions during the year and full reports of their deliberations and recommendations have been published in the Coffee Board Bulletin. The Coffee Services are once again glad of an opportunity to thank members of the Committee for the valuable help and advice they have given.

Coffee Planters' Day

A very successful afternoon was held at the Coffee Research Station, Ruiru, on Thursday, 20th June, and was attended by over one hundred coffee planters. Planters were shown round the station, seeing the progress made to date and being told of future planning.

Coffee Research Station, Ruiru

Whilst much still remains to be done, the development of the new station has proceeded satisfactorily. The first three staff houses and outbuildings to the laboratories were almost completed by the end of the year, and approval for the completion of the whole programme was obtained from Government. It is hoped that the scientific staff will move to Ruiru early in 1948. The Boran dairy herd was moved to the station from the Scott Agricultural Laboratories in April. Fencing of the property is proceeding. A small crop amounting to between eleven and twelve tons was harvested during the year. Of the total, three tons were classified Class I, one and a half tons Class II, and three tons Class III. The total crop proceeds will exceed £1,200.

Entomological Work

With the absence of the entomologist on leave, the entomological work has been carried out by two African Laboratory Assistants under the direction of the Senior Coffee Officer. Technical advice has been given by Dr. Le Pelley, Senior Entomologist. The mealybug situation in areas east of the Rift has been kept under close review, and generally speaking its control by biological means has been satisfactory. Certain breakdowns in biological control have, however, caused anxiety and the need for further research work is appreciated. The Entomologist's spray, as a control for thrips, proved extremely effective on estates where the operations were correctly carried out. Antestia has caused considerable damage in some areas.

Cultural Experimental Work

Meteorological Data.—Records were kept throughout the year at all the main stations and estates on which experimental plots were situated. The attached table shows the monthly rainfall distribution from nine stations.

Experimental Work.—The acreage under coffee at the Scott Laboratories was reduced during the year, leaving only the plot of individual selections for recording. Several new experimental plots were laid down at the Coffee Research Station; effective records will not be available from these for several seasons.

The scope of work on sub-stations was restricted owing to the shortage of staff. The results of work in hand up to 31st March, 1947, are as follows:—

Coffee Research Station, Ruiru.

(i) *Pruning Experiment.*—Re-establishing coffee after stumping. The treatments were:—

- A. Multiple stem.
- B. Single stem—uncapped.
- C. Single stem—capped.
- D. Single two-stem—uncapped.

The layout: Six randomized blocks of four plots. Yields were recorded in pounds weight of cherry.

Statistical analysis of the results showed that the differences in the mean yields of treatments "C" and "A", "C" and "B", "C" and "D", and "A" and "B" were significant at the 0.1 per cent point, that between "D" and "B" was significant at the 1 per cent point, whereas that between "A" and "D" was not significant.

Therefore, after stumping, for the first yield, multiple stem and single (two stem) systems produce the greatest weight of cherry.

(ii) *New Experiments.*—Three new plots have been laid down, viz.:—

Shade-tree Demonstration and Arboretum.—Five species are included in the demonstration: *Ficus* species, *Mæsopsis Eminii*, *Ruprechtia vivoru*, *Erythrina* species and *Entada abyssinica*. These are designed to cover two thousand bushes of single stem and thirteen hundred and sixty bushes of multiple stem coffee. The trees of the Arboretum cover seventeen hundred bushes of single stem coffee.

Shade-tree Trial.—In this trial, there are two blocks, each with one plot of sixteen shade-trees of the six varieties: *Mæsopsis Eminii*, *Entada abyssinica*, *Ficus gnaphalocarpa*, *Erythrina indica*, *Erythrina caffra* and *Ruprechtia vivoru*. These are planted at a spacing of 32 ft × 32 ft., one block covering multiple stem, the other single stem bushes.

(a)	S.A.L. NAIROBI	C.R.S. RURU	Karimani THIKA	Amner KIAMBU	N. Kitito MAKUYU	Kentmere UPPER KIAMBU	Kapretwa ELGON	Ona SOLAI	Expt. Stn. KITALE
January ..	0.18	Nil	Nil	0.05	Nil	0.08	0.11	0.25	0.08
February ..	0.28	Nil	Nil	Nil	Nil	Nil	0.43	Nil	0.37
March ..	0.94	2.12	1.38	1.94	2.53	Nil	2.49	0.05	1.37
April ..	4.32	6.17	8.39	5.18	6.38	8.25	6.98	8.76	6.65
May ..	4.74	8.94	7.05	7.64	4.93	9.54	4.63	4.71	6.78
June ..	0.24	0.15	0.52	0.33	0.02	1.29	12.38	4.58	8.55
July ..	0.47	0.58	0.74	0.23	0.04	0.56	6.18	5.17	6.93
August ..	2.81	1.85	1.60	2.71	0.47	3.10	9.70	5.43	12.51
September ..	4.44	4.38	3.72	5.48	3.07	5.47	3.16	5.15	5.63
October ..	6.40	6.71	4.81	6.42	5.73	7.27	4.63	1.40	1.89
November ..	3.71	6.23	6.74	5.47	8.52	4.47	2.18	2.42	1.39
December ..	2.49	2.72	2.09	3.77	2.91	2.91	2.72	0.40	0.83
TOTAL ..	31.02	39.85	37.04	39.22	34.60	42.94	55.59	38.32	52.98
Number of Days	89	117	110	127	85	128	—	156	—

Selection Trial.—In April, seedlings of twenty-one selections were planted in plots of 4 x 32 trees. Each plot is sub-divided by four treatments for observing their relative merits under multiple and single stem pruning, both shaded and without shade.

(iii) *Manurial Trial and Cultivation Experiment.*—Two layouts were designed by the Agricultural Chemist for trial during 1947.

Scott Agricultural Laboratories.

A further set of individual records was obtained from the selected parent trees and grafted selections. The high yielding propensity of the parent trees is confirmed in some cases. A few of the grafted progeny show good yields, but consistency is generally lacking.

Kitale Experimental Station.

The total rainfall recorded at the station was well above the average, namely 52.51 inches, the average rainfall over 13 years being 45.42 inches. Crop records and observations were continued on the experiments laid down at the station and on the Kapretwa plots.

Sub-stations at Karimani Estate, Thika, and North Kitito Estate, Makuyu.

The plots on these stations were maintained, but on account of the lack of staff no development could be undertaken.

Kentmere Estate, Upper Kiambu.

(a) *Individual Tree Recording.*—The yields of seventy trees were recorded for cherry and clean weight of coffee. Four of these produced more than 2 lb. of clean coffee each. In connexion with the Kiambu characteristic flavour, counts were made of twenty trees for estimates of leaf/crop ratio. Nine of these were shown to approach the desired ratio of one. Reports of liquoring quality are not yet available.

(b) *Cultivation Experiment.*—The layout of seven plots includes cultivation at various times, compost and mulch in seven combinations, each plot sub-divided by pruning at two periods in the season. Again liquoring reports are not yet available. The conclusions must be limited since the area available does not permit replication and randomization of the treatments.

Co-operative Experiments.

(a) *Kituamba Estate, Kiambu.*—Twenty plots under different types of shade-tree and two control plots were recorded for cherry weight and liquoring quality. There is no significant conclusion to be drawn from the difference between types. As in the previous season, the unshaded plots produced the highest yields, but of lower quality coffee.

(b) *Anmer Estate, Kiambu.*—A trial including nine selections was recorded for cherry and clean weights. The highest yields were obtained from S.L. 3, 9, 34 and 30 respectively, all having good liquoring quality.

Conclusion

In conclusion, the Coffee Services wish to thank Mr. Devonshire and his staff of the Liquoring Department of the Coffee Board for their invaluable help rendered during the year.

A. R. MELVILLE,
for S. GILLET,
Senior Coffee Officer.

ANNUAL REPORT OF THE PLANT PATHOLOGIST AND PHYSIOLOGIST, COFFEE SERVICES, 1946

General

Much of the past year has been devoted to a recapitulation and consolidation of previous work. No new major lines of investigation have been initiated, but some preliminary work on shade-tree root systems was commenced. Further research on soil moisture measurement methods has been undertaken, and field observations using a modification of the Bouyoucos electrical resistance block method have been made. Also, the morphological development of the inflorescence bud has been studied in greater detail in order to conclude the flower bud differentiation investigation.

The loss of the Italian co-operator, Paolo Vicinelli, towards the end of February, greatly reduced the possible output of the laboratory, as he had become the equivalent of a second research worker, and although Mr. D. H. Shorman, the new entomological field assistant, assisted me from the middle of October to the middle of November in the absence of the Entomologist, Coffee Services, his valuable help was available for a short time only, and I had no other European assistance.

An exhibit demonstrating coffee root systems and the ways in which they are affected by overbearing, die-back, cultivation practices, and bad drainage, was put up for the annual conversazione of the East African Natural History Society. It is hoped that this exhibit will eventually form the nucleus of the museum at the new Coffee Research Station.

An article, "Growth and Bearing Habits of *Coffea Arabica* in Kenya and Southern India", was published in the *East African Agricultural Journal* (Vol. XI, p. 251, April, 1946) and was reprinted in the *Planter's Chronicle* (Vol. XLI, p. 241, June, 1946).

Together with Dr. H. C. Pereira, Agricultural Chemist, and Mr. E. Cottington, Senior Assistant Agricultural Officer, Coffee Services, a four-day visit to the Coffee Experiment Station, Lyamungu, Tanganyika, was paid in August. Special attention was given to the structure and organization of the laboratories and to the layout of the field trials. The opportunity was taken to visit a number of coffee estates in the Moshi and Arusha areas, where Dr. Nutman had conducted his coffee root investigations, with the result that the physiological background of coffee growing in these areas is now much better understood, a factor of considerable importance when studying the results of the field experiments which have been carried out at Lyamungu, and their bearing on the set-up of similar experiments in Kenya.

Coffee Shade Tree Root Systems

The root systems of two species of trees, the Mukungugu (*Commiphora sp.*) and *Masopsis Eminii*, both widely used as shade for coffee, have been investigated. The method used was similar to that already used for coffee itself. Choosing a radius of a circle centred at the trunk of the tree, a number of holes were dug at intervals of seven feet, starting at the trunk, and vertical surfaces two feet wide and eight feet vertically in the plane of the radius were exposed. A solid rectangle of soil, one foot thick horizontally, was then removed with a strong jet of water, leaving the shade-tree roots exposed. A good picture of the disposition of these roots in the zones of interest to the coffee tree was thus obtained.

The *Commiphora sp.* (Mukungugu), which was a little over ten years old, proved to have a markedly surface rooting habit, very few feeding roots being found below two feet depth. The tree had originally been planted, as is often the case, from a pole which had been thrust into a narrow hole about three feet deep. Roots had been developed largely from the base of the pole and most of them

had avoided the surrounding sub-soil by growing upwards, anastomosing on the way, within the soil which had been refilled into the original hole, forming a sort of basket round the base of the pole. On reaching the level of the top-soil, they bent outwards again and passed out radially from the base of the tree, remaining in the top-soil and producing a mass of feeding roots. These roots are as thickly developed as those of coffee, which is a marked surface feeder. The possession of such a strong surface rooting habit suggests that root competition with coffee may be marked and that the tree should be used with considerable caution as coffee shade. It has, however, already been used with considerable success in the higher middle Kiambu area on Kabazi Estate. It may be that in spite of its strongly developed surface roots, the actual demands for moisture and nutrients are low, but it is perhaps more likely that Kabazi Estate is sufficiently high, and has a sufficiently fertile soil for the benefits of the shade *per se* to counter-balance any adverse root effects. The shifting of the balance, which must always be borne in mind in dealing with shade-trees, as one descends into drier and warmer areas, may well mean that the tree is unsuited for shade at the lower altitudes. It may be remarked that *Grevillea robusta* is reasonably satisfactory at the higher altitudes, but has a very adverse effect on coffee at the lower ones. Until experience on already planted areas has shown whether the Mukungugu is suitable or not for the lower areas, it seems that further planting should be avoided.

The second tree excavated, *Mæsopsis Eminii*, was some twelve years old and had produced a very large trunk and a tall, spreading canopy about seventy feet in diameter. Some large roots passed vertically downwards, others passed out laterally forming an almost solid, massive collar of roots some three to four feet in diameter around the base of the tree on which a number of vertical roots were produced. Most of the lateral roots passing out further sloped downwards or sometimes bent round to vertical after a while. A few, probably not more than four for the whole tree, remained more or less horizontal and supplied the feeding roots in the top-soil. These were not numerous and there were quite considerable areas of top-soil in which practically none were found. Feeding roots in the sub-soil were also not abundant and were usually produced in scattered tufts on the massive, vertical and lateral roots. Thus, in general, the tree would not appear to be more than a mild surface feeder and probably much of its feeding is down at depths beyond the range of the coffee root system. This lends support to the opinion that the tree may well prove satisfactory as coffee shade. It may be remarked here that a better tree, so far as root system is concerned, is *Erythrina tomentosa*, the Muhuti. It has very few lateral roots, feeding or otherwise, down to a depth of fifteen feet, and none at all in the top-soil. The tree is unfortunately slow-growing, perhaps partially due to tip-borer, and the normal form is of a rather dense upright type, but one variety has a better more spreading canopy and it may be possible to control the borer. As the tree is a native of the East Rift coffee areas and is leguminous, it deserves further investigation.

Soil Moisture Measurement

As interest was increasing considerably in cultivation methods and their effects, amongst other things, on soil moisture, and since the latter is obviously of major importance in the study of coffee physiology, further work on the electrical resistance (Bouyoucos) block method for soil moisture determination first investigated in 1944, was undertaken. The apparatus was redesigned and the induction coil source of A.C. current was replaced by a valve oscillator circuit, as the A.C. Wheatstone Bridge, which is the usual instrument for measuring the resistance of Bouyoucos blocks, had not arrived.

Some experiments were conducted to see whether there might be an easier and more direct method of calibrating the blocks rather than by incorporating them in samples of drying soils from the point at which they were to be installed.

It was found that, if dried slowly and placed in a saturated atmosphere to come to equilibrium after each drying session, the moisture content of the surface of the blocks differed little from that at the centres. It is thus possible to follow the relation of block resistance to moisture content by merely weighing the blocks between drying intervals. Using the data for the relationship of block moisture content to moisture tension extracted from Haise and Kelley's paper (Soil Sci., Vol. 61, p. 411, 1946), it was found that the direct readings of the Avo Minor meter scale (using the 0-50 range) were almost linearly related to the logarithm of moisture tension (pF) up to about six atmospheres. It is thus possible for approximate purposes to follow soil moisture tension variations without further calibration of the blocks. The main departure from rectilinearity and, at the same time, the main variation between blocks occurs in the middle moisture tension range, which is one of rapid change in the field and thus of minor importance. It was, therefore, considered worthwhile for preliminary observations on the performance of the blocks to install some, without further calibration, in the field at a number of depths and under varying conditions. The first set were placed in position in mid-June following the cessation of the long rains, which had been very poor. There were four plots, two in coffee and two fallow, one of each pair receiving deep (fork jembe) cultivation and the other a light hoeing, which only disturbed the first inch of soil, but killed the weeds. Blocks were placed at one foot, two feet and four feet vertically above each other at the bottom of 1½ inches augur holes pierced at an angle of 45° to the horizontal for the four foot hole, at 30° for the two foot and nearly horizontally for the one foot. After placing the blocks, soil was filled into the holes and rammed firm.

It was obvious from the start that the deep cultivated fallow plot was much wetter than any of the others. This is perhaps to be ascribed to the heavier growth of weeds developed on it during the long rains. The showers of the latter were sporadic and separated by hot sunny periods. The protection of the soil from sun-baking during these is thought to account for the moister soil conditions. Plants can only dry out this soil to some 20 per cent (dry weight basis), whereas the sun has been found to dry the first 4-6 inches of unprotected soil to as low as 4-5 per cent. The plot dried out very gradually during July and August, the process continuing at depth even during periods of rain, when the surface 1-3 inches was maintained moist. This drying out was presumably due to water (in the vapour phase) being attracted upwards into drier layers to which the rain had not penetrated. The one foot layer naturally dried out faster than the two or four foot layers, but all remained relatively moist, the greatest tension recorded being approximately two atmospheres at the one foot level early in August.

In the other fallow plot, both the two and four foot levels were nearly at wilting point on installation of the blocks, and the one foot level dried out slowly from about 2.5 atmospheres to wilting point in the first month. All levels remained dry until the onset of the short rains at the end of September. The differences between the two plots under coffee were very slight in spite of the differing cultivation treatments. At four feet, both plots were nearly at wilting point, showing that penetration of the long rains had barely passed beyond this level. The one and two foot levels dried to the wilting point within the first two weeks, the deep cultivated plot perhaps drying out very slightly slower. All levels remained dry until the short rains, when the one foot level wetted rapidly, the two foot more slowly and later, and the four foot followed even more slowly and nearly a month later in the deep cultivated plot, and nearly one and a half months later in the shallow cultivated plot. Thus although there is little suggestion for any effect of cultivation treatment on drying, there is a possibility that the rougher deep cultivation (by fork jembe) led to a more rapid absorption of the following rains. From these results, it is considered that even without further calibration of the blocks, the method is capable of yielding estimates of the effects of cultivation and

other treatments on soil moisture if sufficiently replicated. The possibilities of the calibration of individual blocks against moisture tension should, however, be investigated. The experiment was handed over to the Agricultural Chemist, Coffee Services, in September, to whom I owe thanks for the collection of the later data. He is hoping to be able to incorporate the method in a large-scale factorial cultivation experiment to be set up at the Coffee Research Station.

At the end of the short rains a further series of blocks was installed in the coffee from which growth records are taken, at levels of three inches, eight inches (base of top-soil), one foot, three feet, six feet and nine feet. It is hoped that considerable information on the soil moisture relations of coffee will be obtained from the data supplied by these. It may be noted that moisture penetration appears to have been not much deeper than about nine feet during the short rains, although these were relatively good (14.55 inches as against 9.06 of the previous long rains). At the time of writing (mid-February), all this moisture has been used up without any passing downwards to replenish underground reserves.

Coffee Quality

The results from the tests of the Raoeng and Pratt's machines with Upper Kiambu coffee were disappointing as no marked Upper Kiambu type liquors were developed even by normal fermentation methods.

Samples at four different dates during the season were taken and submitted to preparation by the Raoeng pulper, pulping with a McKinnon disc pulper followed by removal of the muscillage by Pratt's machine, and McKinnon pulping followed by normal fermentation. Five replicates of each sample were used for liquoring assessment. The results are summarized in the following table, values for quality being given 1 (good) to 10 (very poor) and averaged for the five replicates. Upper Kiambu scores (equivalent mean greenness, an estimate of the development of the Upper Kiambu type of liquor) were allotted according to the system worked out last year, and similarly averaged:—

<i>Date of Picking</i>	<i>Preparation</i>	<i>Raw</i>	<i>Quality</i>		<i>General</i>	<i>Equivalent greenness*</i>
			<i>Roast</i>	<i>Liquor</i>		
23/11/45	Normal, 36 hours' fermentation	.. 4.0	7.8	5.4	4.5	37.2
	Normal, 48 hours' fermentation	.. 4.0	8.4	5.0	4.5	42.0
	Raoeng pulper	.. 1.4	5.0	4.2	3.4	40.6
	Pratt's machine	.. 3.0	9.0	5.0	4.5	43.2
22/12/45	Normal	.. 1.0	3.0	4.2	4.2	40.6
	Raoeng pulper	.. 1.4	4.0	4.4	4.4	34.8
	Pratt's machine	.. 3.0	3.8	4.4	4.6	44.2
9/1/46	Normal	.. 3.0	3.0	4.2	3.5	33.4
	Raoeng pulper	.. 5.0	3.2	4.0	4.2	33.4
	Pratt's machine	.. 4.0	3.1	4.0	3.5	33.4
2/3/46	All the same, very poor, end of season coffee.					

There are hardly any changes in equivalent mean greenness scores induced by the different treatments, whereas quality seems sometimes to be improved, sometimes to be depressed slightly. As far as commercial quality was concerned, the Raoeng processed coffee was a class better than that prepared by the normal method or by Pratt's machine on the out-turn of 23-11-45; all three methods tied

*The range is normally from 10 to 95, with good liquors scoring about 35 and typical average Upper Kiambu types about 65. Scores below 35 are associated with poorer quality, but of a non-Upper Kiambu type.

on that of 22-12-45 and the Raoeng was a class lower than the other two in the out-turn of 9-1-46. Further tests are being made this season on coffee from a number of Upper Kiambu estates in the hope that some more definite Upper Kiambu liquors will be obtained.

A short investigation of the effect of removing muscillage by lime water as has been suggested by Dr. T. don Clodomiro Picado ("Mehoramiento del café en grano por medios biológicos", Rev. del Inst. de Def. del Café de Costa Rica, Vol. 14, p. 349, 1944) was made on Scott Laboratory Coffee. It was found that it was very difficult to remove more than about three-quarters of the muscillage by this method. A small liquoring test of the rather imperfectly cleaned coffee, however, gave a rather better result than with bowl fermentation or Pratt's machine, but all the bowl fermentations gave very sour liquors. The effect of Pratt's machine seemed to be to lessen somewhat the development of this sourness. It is interesting to note that a number of verdigrise green-blue beans were produced by the lime water treatment, these being always those having had the parchment removed and often also the bean nipped in the pulper. Similar, though rather darker, blue beans were produced when some fermenting coffee was left in contact with a galvanized iron container and very considerably over-fermented. The parchment of a number of beans was also coloured grey. In order to see what sort of damage was done to the liquor by this presumably extremely bad treatment, liquoring samples were submitted. Samples of the same coffee normally fermented in a standard aluminium bowl and others prepared by Pratt's machine were available. Although both these methods produced very poor sour liquors, fair raws and poor roasts, that over-fermented in galvanized iron had a good raw, a fair roast, and a fully fair or fair to good liquor with some suggestion of Upper Kiambu characteristics.

The score table giving figures for "equivalent mean greenness" for liquoring descriptions has been used in assessing the results of a number of past investigations, such as those made in 1945-46 by Mr. A. M. Pratt, then Assistant Agricultural Officer, Coffee Services, on the effects of a number of factory procedures on the development of the Upper Kiambu flavour, and of Mr. S. Gillett, then Agricultural Officer and Experimentalist, on the leaf-crop ratio. I have to thank the latter for generously putting the data at my disposal.

In Mr. Pratt's investigations, a series of samples from naturally low crop, high leaf trees, and from high crop, low leaf trees were examined. Lower scores were obtained with the latter, but the differences between the two sets were not statistically significant, although there were sufficient replications for a fairly small difference to have been detected. Imperfectly ripening cherry (i.e. that not developing a good ripe colour) was found to be more Upper Kiambu in nature and of poorer quality than cherry ripening well; dry fermentation in both cases produced a poorer and more Upper Kiambu type of liquor than under-water fermentation, but the differences were small. Removal of Antestia bitten beans decreased the development of Upper Kiambu type liquor, whereas increased time of fermentation increased it, but the effects were only very small. An attempt to determine the effect of fermenting a non-Upper Kiambu coffee (from Thembigwa Estate) in Upper Kiambu coffee (from Kibubuti Estate) was inconclusive as the former was not a good liquoring sample and had already some development of Upper Kiambu nature, actually more so than the Upper Kiambu coffee into which it was introduced. In this experiment, the effect of under-water as against dry fermentation was nil with the first coffee, but increased the Upper Kiambu nature of that from Thembigwa Estate. Pre-washing of Kibubuti coffee gave a slight increase in Upper Kiambu nature with ordinary estate practice and a slight decrease when fermenting in an aluminium bowl. In general, most of the effects seem to have been small and the experiments would need considerable repetition in order to be sure that the differences were due to more than chance.

In the investigation of the relation of equivalent mean greenness to leaf crop ratio, three seasons' records—the 1942, 1943 and 1944 crops from Kentmere Estate—were examined. In 1942, a good correlation was found, $r = -0.563$, significant at the five per cent point. The relations between equivalent mean greenness and number of cherries, the logarithm of this, the logarithm of the leaf crop ratio, and also with the logarithm of the equivalent mean greenness were also investigated. All were significant, but the best was that of equivalent mean greenness and the logarithm of the leaf crop ratio, which gave $r = -0.607$, a highly significant result. For the relation of equivalent mean greenness to the logarithm of the crop (in numbers of cherries), a significant correlation was found, showing that the size of crop alone gave considerable information on type of liquor, owing to a fairly close correlation to leaf crop ratio.

In 1943, the relation was inverse, $r = 0.124$, which is very low, almost sufficiently so as to be taken as evidence against any relation existing. Again in 1944, the relationship, if any, was inverse. In both these years, low ratios were the rule and in 1944 no markedly Upper Kiambu type liquors were obtained.

It is evident that correlation between leaf crop ratio and equivalent mean greenness is seasonal and holds only in seasons when the Upper Kiambu type of liquor predominates.

Some further information was obtained from an analysis of data from Njuno Estate. The following correlation co-efficients were obtained for the following relations:—

Equivalent mean greenness to number of leaves ..	$r = +0.298$
Equivalent mean greenness to the logarithm of the number of leaves	$r = +0.033$
Equivalent mean greenness to the leaf crop ratio ..	$r = -0.716^{**}$
Equivalent mean greenness to the logarithm of the leaf crop ratio	$r = -0.637^{**}$
Equivalent mean greenness to the logarithm of the crop number	$r = -0.312$
Logarithm of the equivalent mean greenness to the logarithm of leaf crop ratio	$r = -0.458^{*}$

* Significant at the five per cent point.

** Significant at the one per cent point.

The high value for the relation of equivalent mean greenness to leaf crop ratio is noteworthy and shows that in certain seasons much of the variation in liquor may be accounted for by the leaf to crop factor alone. It was found that the best liquors were all obtained with ratios not diverging far from 1.0. As higher ratios, i.e. larger crops supported by fewer leaves are obtained, so quality decreases, although a non-typical type of Upper Kiambu liquor, often common or sour in nature, may be produced. Low ratios usually produce typical full bodied, low acidity strong coffees, but there is a suggestion that low-leaf low-crop types tend to sour liquors. High-leaf high-crop types similarly may produce low quality. It would appear that the type to aim at is that having an average crop well supported by leaf, and biennial bearing, even if mild, is to be avoided. However, the balance is a very delicate one and even if carefully maintained, can only minimize the risk of producing poor quality coffee in an adverse season. Seasons evidently, from the Kentmere data, have a strong influence, stronger than the leaf crop ratio. A dry year probably means that lower crops associated with lower leaf crop ratios are less likely to produce the Upper Kiambu characteristic flavour. Higher crops, on the other hand, are perhaps then more likely to produce poor quality coffee of the light acidity, full body type, but sour or common rather than strong.

Flower Bud Development

The relation between anatomical structure and determination of flower bud has, up to the present, only been rather cursorily investigated. In order to conclude the investigation of the determination of the flower bud, monthly collections of six branches selected at random from three trees were made, the branches having been previously marked for extent of long and short rains growth. The stage of development of the inflorescence buds in the leaf axils developed in the long and short rains was investigated by dissection under the dissecting microscope, and also by microtome sections. The investigation was commenced in June and will consist of twelve monthly observations, six for the long rains growth and six for that of the short rains, thus covering the period from axillary bud initiation to flower opening.

Growth Observations at the Scott Laboratories

These were continued, but at fortnightly instead of weekly intervals. The unwatered trees showed better growth than in 1945, there being two well marked maxima corresponding to the long and short rains, that of the former being somewhat less accentuated, as would be expected from the relative rainfall of the two periods. The August rains produced a rather small but distinct growth period. Following on the very large flowering of the short rains of 1945, which had resulted from the strongly marked short rains growth period of 1944, there was only a very small flowering in the long rains, smaller than might have been expected from the corresponding growth period of 1946, due no doubt to the fruit which was developing from the short rains flowering. In the watered trees the position was reversed, the short rains flowering being rather small and that of the long rains (1946) being very strong, as had been expected from the corresponding growth periods of 1944 to 1945. Much of the flowering on the unwatered trees failed to develop into fruit (more than 95 per cent) and only a very small crop resulted. The small short rains growth period of 1945 has been mirrored by a similar small short rains flowering in 1946. It is expected that the fair growth during the long rains, coupled with less adverse conditions than usual during the following August and the lack of crop on the trees, will lead to a good long rains flowering in 1947.

The watered trees showed a more marked long rains and a much less marked short rains growth period, presumably owing to the heavy crop which they were bearing. The watering has produced a high even cropping each year since it became effective in 1944, as is shown in the following table of yields, converted to hundredweights per acre for the watered and unwatered trees:—

	Tree No.			1944-45	1945-46	1946-47
Unwatered trees, Average 3.9 cwt.						
	1	..	..	nil	6.9	1.7
	2	..	..	0.3	10.3	0.5
	3	..	..	0.7	17.2	0.5
	4	..	..	nil	0.8	1.2
	5	..	..	1.0	7.7	0.5
	6	..	..	4.8	14.7	1.3
Watered trees Average 11.6 cwt.						
	7	..	..	10.8	10.2	10.9
	8	..	..	12.9	11.2	17.4
	9	..	..	12.5	5.3	13.3

The much greater variation in yields of the unwatered as compared to the watered trees is noteworthy. The latter were also more regular in their flowering habits, producing a small short rains flowering and a large long rains flowering each year; this is correlated with a similar distribution of growth. The short rains growth is always depressed by the presence of a large ripening crop on the trees. It is interesting to note that in April a fairly severe attack of thrips occurred on the unwatered trees, but not a single insect could be detected on the watered ones.

Bouyoucos blocks have now been installed at depths down to nine feet amongst these trees. From their behaviour in the watered block it appears that in spite of watering, the soil gets drier as depth is increased and that rains can appreciably alter the moisture tension even in the first few feet of soil. This presumably accounts for the growth correlation with rains noted in the last annual report. It is apparent that during the drought years coffee has been without the normal reserve of moist soil at depth and has had to rely entirely for its supplies of moisture on the water in the first few feet of soil, which has rapidly disappeared following the rains, and it has, in fact, become almost entirely a surface feeder.

R. W. RAYNER,
*Plant Pathologist and Physiologist,
Coffee Services.*

ANNUAL REPORT OF THE AGRICULTURAL CHEMIST, COFFEE SERVICES, 1946

After arrival in mid-June on first appointment the remainder of the year has been spent principally in reconnaissance of coffee problems, both in the *shamba* and in the laboratory. Many visits have been made to coffee *shambas*, both east and west of the Rift Valley. Reading of applicable research work published during absence on military service has occupied an appreciable period. Much essential data obtained by the Plant Pathologist and Physiologist of the Coffee Services, Mr. R. W. Rayner, has been studied and discussed in detail with him. A brief but valuable visit was paid to Lyamungu Coffee Research Station, where field experiments of a very high standard were studied, and useful data on plot size and yield variance obtained.

Experimental work has been started on the following problems:—

Cultivation Methods and Weed Control

A comprehensive field study of basic coffee cultivation practices has been designed in the form of a 3^4 confounded factorial experiment. The treatment combinations were described in the Coffee Board's bulletin of October, 1946. An area of recently regenerated coffee on the Jacaranda Coffee Research Station has been selected for the experiment, and crop yields are now being recorded to assess the variability of the trees before treatments are applied. Individual tree yield records are being statistically analysed for further evidence of crop behaviour in different districts.

Soil Moisture Content

Preliminary work has been confined to study of recent advances in theory and technique, and to observations of the field behaviour of electrical resistance apparatus (Bouyoucos blocks) already laid down in coffee by Mr. Rayner.

Spectrographic Analysis

A Hilger Medium Quartz Spectrograph was returned to the Scott Agricultural Laboratories in July, after war-time loan to Tanganyika. This instrument has been set up, and the somewhat complicated accessories required for the flame method of plant tissue analysis (as used by Dr. Roach at East Malling) have been improvised from aircraft salvage materials.

Leaf Tissue Testing

Colorimetric methods for the chemical estimation of nutrients in leaf tissue were begun. Unexpected variations in the results for phosphate estimations led to a detailed quantitative trial of various alternative methods.

General

Ad hoc work in this period has included the following problems—

- (a) Trials of a newly available form of D.D.T. emulsion as a sprayed-band for mealybug control. This work, undertaken in collaboration with the Senior Coffee Officer during the absence on leave of the Coffee Services Entomologist, was reported in the Coffee Board's bulletin for January, 1947.
- (b) A small-scale test showed D.D.T. emulsion to be useful as a protective spray for coffee-drying ground-sheets.
- (c) The testing of methods for the removal of a phenol taint from certain batches of sisaltex coffee-drying sheets showed river water for 12 hours to be as effective as various solutions of caustic soda and magadi soda. The results were broadcast to coffee planters.
- (d) A trial of accurately-controlled hot-air treatments of hulled coffee, in an effort to remove taints, did not succeed in removing the phenol taint mentioned above, even at temperatures as high as 85° C. (185° F.). The tolerance of hulled coffee to hot air drying was found to be limited to two hours at 65° C. (149° F.). This only slightly affected the raw appearance, and did not, in the opinion of the Coffee Board's Liquorer, Mr. C. R. Devonshire, lower the classification of the coffee. The possible effect of this treatment on other taints is under investigation. Drying for more than two hours at 65° C., or for any period at a higher temperature, produced severe deterioration.

This opportunity is taken to thank Mr. Devonshire for his ready co-operation. Thanks are also due to all members of the Coffee Services for their great assistance to a new member of the team, and to both Mr. Beckley and Mr. Gethin Jones for their very kind advice and co-operation at the Scott Agricultural Laboratories.

H. C. PEREIRA,
Agricultural Chemist,
Coffee Services.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL CHEMIST, 1946

Administration

The Senior Agricultural Chemist assumed administration of the laboratories and field in April. There have been many changes in the staff of the chemical section during the year under review. Three officers have left and four have either rejoined from the Army or have been newly appointed. Details are given below:—

F. McNaughton, B.Sc., A.R.I.C., Pyrethrum Chemist, promoted to Assistant Government Chemist.

G. M. F. Grundy, B.Sc., appointed Laboratory Assistant on probation, 4th March, 1946.

Mrs. M. G. Ballance, Laboratory Assistant, resigned, 15th April, 1946.

J. Hopkins, M.P.S., Laboratory Assistant, returned from the Army, 15th July, 1946.

S. B. Knowlden, Junior Laboratory Assistant, resigned, 27th August, 1946.

B. A. Wyndham, appointed Junior Laboratory Assistant, 28th October, 1946.

W. Politzer, Junior Laboratory Assistant, returned from the Army, 1st December, 1946.

As a result of contributions from the Pyrethrum Board, mainly with the idea of securing a modicum of grading by analysis, several African assistants have been employed. It is gratifying to report that these Africans are very quickly learning their duties and becoming most valuable assistants; one who has been employed for some years is a highly efficient pyrethrum analyst.

With all these changes in staff, it would be expected that there would be depreciation in the quality of the work done. Here, too, it is pleasing to report that officers who have returned after years in the Army have very quickly regained their old dexterity.

Work Done

There has been an increase in the number of samples received for analysis, of about 160, due very largely to the great increase in the number of soil samples. The nature of the samples received is given in the following table. This table does not give a true picture of the work done, as many samples have been the subject of investigation which involves a good deal of work. The table is merely a rough indication.

Nature of Sample			Outstanding at 31-12-45	Recd.	Refused	Exam. at 13-12-46	Outstanding at 13-12-46
Pyrethrum—							
Control	..	..	22	327	—	278	71
Breeding	..	..	—	129	—	129	—
Investigation	..	..	—	26	—	26	—
Soils	..	..	—	662	—	662	—
Manures	..	..	1	92	1	92	—
Waters	..	..	—	17	—	17	—
Insecticides	..	..	—	39	—	39	—
Feeds	..	..	—	9	—	9	—
Dried Vegetables	..	..	—	89	—	89	—
Grain	..	..	—	11	—	11	—
Oils and Waxes	..	..	—	9	—	9	—
Miscellaneous	..	..	4	28	—	32	—
Total	..	..	27	1,438	1	1,393	71

Pyrethrum

The results of the analyses of the control samples of pyrethrum give a very good picture of the state of the pyrethrum industry during the year. There has been a slight decrease in the amount exported. On the whole, the production of the crop has been much the same as in previous years. The samples received during April and May were very few indeed. The period of low production, however, has been shorter than usual. It is impossible to make any comment on the course of the pyrethrum content owing to the fact, as will be explained below, that a change was made in the method of analysis.

Complaints continued to be received during the year that Kenya pyrethrum was showing a very rapid and marked deterioration between the time of baling and that of arrival and sampling at New York. Had there been an alteration in the method of baling, this might be explicable. There has been none at all.

A study of the analytical reports received show that there is very poor concordance between the results obtained upon supposedly duplicate samples made by different analysts. Either the method of sampling is poor or the different analysts are employing different methods. Perhaps both factors are involved. It is established that in the U.S.A. buyers insist that the Seil method of analysis should be employed in determining the pyrethrin content of the samples taken from a shipment. In Kenya we have been employing the official method of the Association of Official Agricultural Chemists, an American organization of world-wide reputation. However, to meet the demands of the American buyers and as suitable apparatus was available in the laboratory stocks, a change was made in August to the Seil method of analysis as published in the "SOAP." Blue Book of 1939.

Although supposedly we are employing the same method of analysis as the analysts in the U.S.A., there are still grave discrepancies between our results and those accruing in the States. As a result of collaborative work made some years ago, it is possible by calculation to make a very fair estimate of what should be the pyrethrin content of any one consignment, but there is no agreement. Further investigations carried out by the agents of the Kenya Farmers' Association in the U.S.A. have shown that one of the analysts, at least, is employing modifications to the Seil method which have not been published. Indeed, it was stated that a certain modification was being employed which, when applied in the laboratories here, gave extraordinarily high results for Pyrethrin I, and very low results for Pyrethrin II. The sum of the two figures gave a figure much below that for total pyrethrins by the normal method. Such modifications to a published method are unjustifiable and, in all probability, cause the peculiar results which have given rise to a great deal of controversy. Perhaps to clarify the position a short account of the methods of analysis and the steps that are being taken to secure uniformity would be of value.

In the analysis of pyrethrum flowers the pyrethrins are not themselves isolated but the estimation is dependent upon certain properties of the constituents. The pyrethrins are esters, that is to say, compounds of an alcoholic portion and an acidic portion. The alcoholic part of both pyrethrins is a complex ketonic alcohol, known as pyrethrolone which, besides being an alcohol, is also a ketone. As such, it reduces the well-known reagent, Fehlings Solution, a copper reagent. This property was utilized by Gnadinger & Corl in their copper reduction method. This method of estimating pyrethrins does not differentiate between Pyrethrin I and Pyrethrin II—only total pyrethrins. It is a good method, very sensitive, and in the hands of experienced workers gives concordant results. It is, however, very sensitive to certain impurities which sometimes exist in fresh flowers.

The acid parts of the two pyrethrins are different; that of Pyrethrin I is known as Chrysanthemum-monocarboxylic acid, and that of Pyrethrin II as

Chrysanthemum-dicarboxylic acid. The acid of Pyrethrin I is volatile in steam, whilst that of Pyrethrin II is not, but can be extracted from water solutions by means of ether. These differences in properties were first employed in analysis by Tattersfield. Seil later simplified Tattersfield's technique and introduced certain improvements that removed impurities liable to affect the results. Ripert also evolved a method utilizing the same properties. This is much more complex than that of Seil. The result was that the Seil method became fairly widely used.

Without going into details, Seil's method is as follows:—

Properly ground pyrethrum flowers are extracted in a continuous extractor with petroleum ether. Petroleum ether is then removed and the pyrethrins split up into their two constituents by boiling with alcoholic caustic soda. After dilution the alcohol is boiled off. To this solution is now added barium chloride which combines with many of the impurities forming an insoluble precipitate. This is filtered off. A measured fraction of the solution is acidified and then subjected to steam distillation for the removal and collection of Pyrethrin I acid. In the residue is Pyrethrin II acid which is extracted by means of ether. The quantities of both acids are easily estimated. There have been many criticisms of Seil's method and, incidentally, of the other methods utilizing the same basic procedure. It has been shown by many workers that in the steam distillation there is a marked decomposition of the Pyrethrin I acid. True, a certain amount of another acid is produced but it does not fully compensate for the loss. This loss also occurs when the pure acid is subjected to steam distillation; in these laboratories a recovery of only 86 per cent was obtained. Since publication modifications have been made in the procedure, one of which appears to consist in carrying the steam distillation down to dryness. Such a procedure gives an enhanced figure for Pyrethrin I because of the volatile acidic decomposition products that are produced.

Seil also observed that Deniges reagent reacts with Pyrethrin I acid, producing a characteristic series of colour changes, the reagent being reduced. This reaction was employed by Wilcoxon as the basis of a method of analysis. Later, the procedure was modified by Holladay. As a result of collaborative work, this method was accepted as the standard method by the American Association of Official Agricultural Chemists. At the time of the original work, there was no really pure Pyrethrin I or its acid available, and it was thought that the reduction followed a certain course. As a result of this, a factor for calculation of 4.4 was evolved. In the last few years, however, pure Pyrethrin I and its acid have been prepared and a study of the reaction has shown that its course was not that originally believed, but that a very different factor, namely 5.7, should be employed. This new factor has caused a certain bitterness in some fields.

In the mercury reduction method, the first steps are identical with those of the Seil but, after acidification, the free Pyrethrin I acid is extracted from the water solution by means of petroleum ether, from which it is removed by means of very weak caustic soda, in which form it is treated with Deniges reagent. The extraction of the Pyrethrin II remains basically identical with that of Seil's procedure. It is evident that the less drastic treatment in the mercury reduction method is not liable to cause decomposition of the Pyrethrin I acid, and is thus free from the many criticisms levelled against Seil's method.

When regular pyrethrum analysis was started in these laboratories, the various methods then available were examined. Seil's method is easy to carry out, but the great difficulty lay in the fact that here ether necessary for the extraction of the Pyrethrin II acid boils at a very low temperature and high pressures are set up in the extractors employed. At that time, too, glassware was not as good

as it is to-day and stoppers were very often driven out of the extractor with consequent loss in the form of spray of the ether. Therefore, the copper reduction method was employed, even though it was more difficult.

In 1939, the writer's attention was drawn by Dr. Graham of the United States Department of Agriculture to the mercury reduction method for Pyrethrin I, and a modified Seil for Pyrethrin II. This method appeared to be highly suitable, and as it was about to be accepted by the Association of Official Agricultural Chemists, there was a possibility that, if any change was made in the technique employed, it would be to this. Early in 1940, at the tail end of the crop, extraordinary difficulties were experienced in the copper reduction method, and most divergent results were obtained in duplicate analyses. It appeared that under these conditions something is developed in the flowers which severely interferes with the reduction of the copper reagent. It was evident that a change would have to be made and, accordingly, the official method of the Association of Official Agricultural Chemists was employed. By this time standard joint glassware was available, in which the stoppers of the necessary extraction apparatus are far better ground, and it was found that the danger of their being driven out was non-existent.

In the annual report for 1945, it was stated that arrangements had been made for a critical survey to be made in Britain of the methods of pyrethrum analysis. A report was received during the year, in which preference was expressed for the mercury reduction method for Pyrethrin I, and a modified Seil for Pyrethrin II. With some of the details of the proposed method the writer did not agree—they tended to complicate the technique, making it difficult to maintain the smooth established routine of these laboratories without affecting the accuracy of the results. As a result of correspondence, collaborative work was conducted between the chemists here and a number of chemists in Great Britain to study the proposed method of the Committee in Britain and the method proposed by the writer. A report on this work has not yet been received but, based upon this work, arrangements have already been made for a world-wide collaborative scheme of work to study the proposed methods. It is hoped that this collaborative work will secure uniformity in the methods of analysis and that the acrimonious discussions which have been going on will cease.

Waters

During the year a Water Pollution Research Committee was instituted, of which the writer is Chairman. This Committee is working in close conjunction with the Water Research Board of the Department of Scientific and Industrial Research in Britain, which Board has sent out an officer to study the problems of the purification of the effluents from coffee and sisal factories. This officer is conducting his experiments on chosen estates.

The most interesting item of investigation on water was that of a sisal estate. Some years ago the water supply of this estate was polluted by clay from severe erosion in the Native Reserves above. Suspended clay stained the fibre red. In order to stop the clay from reaching the supplies, a heavy growth of papyrus and other water weeds was encouraged upstream. Some little time later another difficulty occurred. Although the water was quite clear, there was something in it that tended to deposit black material on the fibre. It was found that this black material was sulphide of iron. In a swamp there is a tendency for bacterial action to render iron compounds soluble in the form of iron (ferrous) carbonate. This, coming into contact with a supply of sulphuretted hydrogen, would give a black sulphide. A search of the various small streams entering the main supply showed that one very small spring was polluted with sulphuretted hydrogen. This was diverted and, for a time, the water supply was satisfactory, but again there was a

stain on the fibre. It had a dingy greyish tint. Investigation of both fibre and the waters showed that this was due to iron carbonate in solution. On drying the fibre that had been washed in such water, an oxide of iron was deposited on the fibre, spoiling its appearance. In the laboratory it was found that bubbling air through the water removed the iron. It was, therefore, suggested that the estate institute a system of sprays to thoroughly aerate the water so depositing the iron in a flocculent form, which can be very readily filtered from the water. This suggestion has been followed. It now appears that the treatment has rendered the water highly satisfactory.

Insecticides

The study of the new insecticides, D.D.T. and Gammexane, has been continued and further uses for them have been investigated. D.D.T., as now supplied, is a comparatively pure substance. Gammexane, on the other hand, is not. The crude material, Benzene Hexachloride (BHC), or 6 6 6, exists in at least four forms, only one of which is highly toxic to insects, the others are either only slightly poisonous or not at all. Gammexane is the toxic form and generally exists to the extent of about 13 per cent of the crude BHC.

In the early part of the year there was a recrudescence of mealybug on coffee and there was very little banding grease available. In conjunction with officers of the coffee team, an experiment was put down, in which both D.D.T. and BHC were applied to the trunks of trees in the form of a narrow band of a kerosene solution. The D.D.T. solution had a strength of four per cent and was found to be highly efficacious in keeping insects off the trees. The Gammexane solution was made from a concentrated preparation which contained 70 per cent of BHC, about nine per cent Gammexane, in dekaline, which was diluted with kerosene to a final concentration of 3.5 per cent BHC. This material had very little effect in keeping ants off the trees. Where dust had been used under the trees, far greater control was secured. Laboratory experiments were, therefore, instituted to determine the effect of both D.D.T. and Gammexane upon the ant. D.D.T. affected the ants comparatively quickly, but a dilute solution of the dekaline solution had little effect. Where BHC was extracted from the dust and applied in the form of a weak kerosene solution, the ants were more quickly killed than with D.D.T. A small field experiment confirmed that where a pure kerosene solution of BHC was used, the Gammexane was highly efficacious in keeping the trees free from ants. It is very evident that here we are dealing with one of those peculiar complexes in which the carrier of the toxicant does not part with it to the insect.

This phase of insecticidal work is being studied in Britain, but it is very evident that a great deal more fundamental work upon the complex of the toxicant—carrier—insect is essential. This work is of a character which cannot be done here, calling as it does for close collaboration between organic chemists, colloid chemists and entomologists.

In Britain it has been found that Gammexane is a valuable soil insecticide. Material has been obtained from I.C.I. for a large-scale experiment in conjunction with the Entomological Section on its use against the cockchafer grub. Its use as a protection for the mustard plant will be discussed later.

In last year's report the possibility of the use of Gammexane in the form of smokes against termites was mentioned. Experiments have been conducted again this year, but the results have not been so encouraging. It would appear that distribution in the nest is not even and parts receive very small doses, which parts are then sealed off by the termites who were able to continue as weakened colonies. Treated nests are being kept under observation.

In an inter-territorial conference on the use of new insecticides it was decided that legislation was necessary to control the use of insecticides. It was also considered essential that there should be proper control of the sale of all insecticides and that there should be no possibility of unscrupulous manufacturers supplying materials of little efficacy at high prices. Legislation has been drafted by a sub-committee appointed by the Conference, based upon the laws of Great Britain, South Africa, Queensland, New Zealand and the U.S.A. This legislation is now being considered by the various East African Governments. In it we have taken into consideration not only the control and sale of insecticides, but of fertilizers and other economic poisons such as fungicides, dips, etc.

Dried Vegetables

A certain control was maintained on the quality of the produce of the dried vegetable factory, in which representative samples were examined and subjected to panel tests. On the whole, the quality of the material, especially that of dried potatoes, was uniformly high, although at times there was material which showed that the enzymes responsible for rapid deterioration had not been completely destroyed. It is difficult to account for this as the same procedure has been maintained almost throughout. Possibly some varieties of potatoes are more resistant to the steaming than others.

Grain

In last year's annual report it was stated that apparatus suitable for the determination of moisture in grain had been purchased on behalf of the grain conditioning plant. This apparatus is a standard form and widely used, but the determination takes rather a long time. There are periods when it is essential to get a figure quickly, approximate perhaps, of the moisture content of a lot of grain. During the last year or so a very quick moisture tester has been evolved. This consists of a steel vessel with a quick seal, into which is placed a weighed amount of the grain, finely ground, and a measured quantity of powdered calcium carbide. The moisture in the grain reacts with the carbide producing acetylene gas, thus altering the pressure in the closed vessel. The alteration in pressure is recorded on a dial as moisture content. The results indicated by this machine are not absolutely accurate, but they do give an approximation to within half per cent; the whole procedure takes a minute or two. For quick routine work the value of such an implement is evident.

Essential Oils

Now that the war is over, farmers and intending settlers are looking for crops alternate to the normal staple farm crops, and it is not surprising that a great deal of interest has been evinced in the possibility of essential oil production. The very high prices for essential oils obtained during the war have given an incorrect picture of the economics of essential oil production. At the present time quite small acreages would be profitable. Prices are already falling and the returns from small acreages will not bear the cost of expensive stills. For economic production large acreages will be needed, perhaps a distillery will have to be run on a co-operative basis by a group of farmers growing the crops. In any case, the production of essential oils is unlikely to be much more profitable than normal farming.

There has been an increase in the area planted to Geranium. Several people have collected quantities of cuttings from the plots maintained at the laboratories to provide a nucleus for future planting. There has also been an extension in the planting of Lavender. Both Lavender and Geranium must be vegetatively

propagated, as the plants from which the established qualities of oil have been derived are hybrids and do not breed true from seed. Search is being continued for other suitable essential oil producing plants.

Interest has also been evinced overseas in the possibility of extracting waxes from sisal waste. The epidermis of the sisal leaf has quite a fair waxy coating and from it waxes could be won. Work has been started to find an economic method of extraction.

Miscellaneous Investigations

During the year it became necessary to make several analyses of nicotine concentrate. It was impossible to obtain concordance between the quick method and the standard method, which involves precipitation with silico-tungstic acid. The results by the latter method were considerably lower than by the quick method, although earlier work had always shown remarkable concordance between the two. With the silico-tungstate it was found necessary to give a very large number of washings of the precipitate before it was free from soluble silico-tungstates. This made one wonder if, perhaps, there was not another related alkaloid present in the nicotine. Investigation into this subject was commenced and the results which were obtained led to an investigation of the reagent itself. It was found that the reagent had deteriorated. Normally speaking, silico-tungstic acid is a stable material and, as long as it is kept in a closed bottle, should undergo no deterioration. When completely fresh reagent was used, complete concordance was again obtained between the quick method and the precipitation method. What happened to the reagent it is not possible to state as time could not be spared to conduct the investigation, but it is very evident that bottles of the reagent, after opening, must be very carefully sealed to prevent any deterioration occurring and that, before use, the reagent itself must be carefully examined.

In the decortication of sisal, acid juices are squeezed out from the tissue which go down the drain with the waste. These acids, if recovered, could readily be sold. Simple concentration of the effluent would be far too expensive a means of recovery. In recent years, however, materials have been evolved for water purification which remove both bases and acids. For example, a water containing sulphates and chlorides of, say, sodium, calcium, and magnesium, when passed through a column of one of the materials, loses the sodium, calcium and magnesium, leaving behind in solution the two acids. Passing this water through another column of the other type, the acidic radicals are extracted, leaving an extraordinarily pure water. It is hoped to apply this system to the concentration of the acids in sisal juices. The Permutit Company has very kindly supplied working samples of the two materials and work on the subject has been instituted.

Field Experiments with Silicophosphate

At the beginning of the year a demand was made for information regarding the response of soils throughout East Africa to silicophosphate. An Inter-territorial Committee of Agricultural and Soil Chemists met to discuss the matter, and it was decided to lay down field experiments on an inter-territorial basis, the Soil Chemist at Amani co-ordinating the whole organization and correlating results. Therefore, although a large number of experiments, statistically designed and otherwise, has been carried out during the year, it is not intended to comment on these in detail. A full report will later be issued by the Soil Chemist of Amani. It may be mentioned, however, that where the soil has not deteriorated badly, a lack of other plant nutrients providing the limiting factor, very marked responses, in cases up to 85 per cent increase, have been obtained from normal applications of silicophosphate. There is no doubt that as far as Kenya is concerned, silicophosphate would be a very valuable phosphatic fertilizer.

· Weedicides

The early weed killers were materials such as salt, sodium arsenite and sodium chlorate which, when applied in sufficiently strong solutions, killed all weeds. Such weed killers are useful for keeping roads, railway tracks, and paths clear of vegetation. On these situations all plant growth is a weed, a weed being defined as a "plant growing where it is not required". Such drastic weed killers are unsuitable for normal agriculture, where one, perhaps, wishes to destroy charlock in wheat without affecting the wheat itself. One of the earliest chemicals to be used for this purpose was ammonium sulphate which adheres to the hairy leaves of the weed but drops off the smooth leaves of the wheat plant. Its efficacy was dependent upon fine weather, rain would wash the dry material from the weed leaves and ammonium sulphate in the soil would stimulate its growth. Later came the use of dilute sulphuric acid, solutions of copper sulphate, iron sulphate, and of copper chloride and, more recently still, the use of the material commonly known now as DNOC (Dinitro-orthocresol) in the presence of ammonium salts. These materials have proved quite efficacious for the destruction of weeds in cereal crops. Their application, however, is rather difficult; special spraying machinery is necessary to stand up to the corrosive effects of some of these materials, machinery that the ordinary farmer would not possess. DNOC, too, is sometimes rather uncertain in its action.

During the last few years a great deal of work has been done upon the so-called "plant hormones". These materials are substituted acetic acids (acetic acid is given the chemical form of CH_3COOH , one of the H's attached to the first "C" is replaced by another group and its character completely altered). One of the first to be studied is that known as Indolyl-acetic acid which was found to have, in very dilute solution, remarkable effects in stimulating root growth on cuttings. This was rapidly followed by Naphthalene-acetic acid. Both of these materials are in standard use as root promoters of cuttings. It must be understood that these materials are true compounds and not mixtures. In a gardening paper this point was not appreciated, and it was suggested that a mixture of naphthalene and vinegar would promote root formation on cuttings. Naphthalene-acetic acid has also been found to be of very great value in preventing premature fruit drop with apples and pears.

Only at great dilution do these materials give beneficial effects; used too strong they damage or even kill the cutting. It was observed that while a fairly strong solution of naphthalene-acetic acid damaged seedlings of dicotyledons cereal seedlings were unaffected. There is a differential effect which indicated the possibility of the use of these materials as differential weed killers. Search was then made for related substances as efficacious as, but more cheaply prepared than, naphthalene-acetic acid. Two were outstandingly efficacious. These are 2. methoxy-4, chloro-phenoxy-acetic acid, MCPA, and 2.4 dichloro-phenoxy-acetic acid, DCPA or 2.4.D. Both these materials, at a dilution of .01 per cent, are powerful weed killers; the latter, at a dilution of 1 in 2 million, has the peculiar property of making fruit set, especially in the case of tomatoes, without fertilization. These two materials are being used in commercial weed killers under the names of Methoxone (I.C.I.) or Agroxone (Plant Protection, Limited), the active agent in these two being MCPA, Weedone (May & Baker), the active agent being DCPA; the latter under the designation of 2.4.D. is widely used in America. Through the courtesy of Messrs. I.C.I. and Messrs. May & Baker working quantities of these weed killers have been obtained.

The action of these weed killers is peculiar. The older types scorch the vegetation to which they are applied; these do not. The first effect visible is a strange distortion of the young parts of the plant which gradually spreads down through

the older parts. In several affected plants the leaves die in patches and finally the whole plant. In those slightly affected there may be distortion of the stems depressing the whole plant; in others the leaf tissue grows between the veins, while in others the effect is confined to the growing point.

The first trial was with Methoxone dust. This was applied to a piece of very weedy Rhodes Grass at rates which gave applications of 1 lb., 2 lb., and 4 lb. of the active agent per acre. Frankly, our first impressions were those of disappointment. The weeds, especially Mexican Marigold, appeared to be slightly affected only. There was a small amount of distortion, but they seemed to recover. *Datura* looked very sick for a day or two, but also began to recover. The plots were not visited after this for a period of a month, when the real effect of the weed killer was easily visible. The boundaries between the treated and untreated plots were easily picked out by the absence of visible weed growth in the dusted plots. Although, perhaps, the weeds were not immediately killed, they were so stunted that the grass was able to grow over them and so complete the killing.

A second experiment was then put down on a stretch of weed-infested grassed drain. In this experiment Methoxone dust, Methoxone liquid, and DNOC, in the form of sodium and ammonium salts, were applied. The DNOC, especially in the form of the ammonium salt, gave an immediate scorching effect upon all the weeds and, at the higher rates of application, 10 lb. of the active agent per acre, also scorched the grass. The weeds, however, did recover. With the Methoxone dust and liquid many of the weeds, notably charlock, were very quickly killed; others were depressed. One of the most interesting effects was that upon the devil thorn, which showed a depression very quickly, but was not killed. The long flowering spikes developed, but no seed at all was produced. Some of the more sensitive plants showed most curious distortions and, before death, were very severely twisted. It was evident in this experiment that Methoxone, in the form of a spray, was much more efficacious than the dust.

A large-scale experiment was then laid down, two fields had been sown with *Trans Nzoia* Rhodes Grass; weed growth in these fields was so heavy as completely to cover the young grass which was, therefore, suffering from competition. One of the fields was then divided into three. One portion was sprayed with Methoxone at a rate to give an application of 1 lb. MCPA per acre. The weeds in this area were mainly pig-weed, *Macdonaldii* and devil thorn. The effect was very rapid indeed and, in the course of a couple of days, the weeds were lying down and the grass coming through. Ten days later the second portion was sprayed. Here again the effect was rapid. Ten days after this the third portion was sprayed. Here the weeds, being older, the effect was not so spectacular. The other field was now treated. The development of the grass in the first field was most interesting. At the time of cutting, in the first portion the grass stood almost three feet high, in the second between two feet and two feet six inches, whilst in the third portion the growth was much shorter, demonstrating the very deleterious effect of weed competition and the beneficial results of early treatment. Both fields, during the short rains, made wonderful growth and were practically free from all weed growth.

By this time Weedone, DPCA, was available, so a third small experiment was laid down in which Methoxone dust at rates to give 1, 2, and 4 lb. MCPA per acre; Methoxone liquid at rates to give 1 and 2 lb. MCPA per acre, and Weedone liquid at rates to give 1 and 2 lb. DCPA per acre, were compared. The DCPA at both rates appeared to work more rapidly than the MCPA. Unfortunately, owing to dry weather, it was not possible to ascertain whether these two materials had any effect upon the development of seedling weeds. One of the most striking

results was upon wild lettuce, a weed that has a very deep rhizome from which new plants arise. In one of the more heavily sprayed plots this weed was very quickly killed above ground. The effect in a contiguous, lightly dusted plot was comparatively small, but after a while it was noted that the plants nearest the boundary were beginning to be severely affected. The effect gradually spread to all plants in the lightly dusted plot. Apparently the poison was spreading along the rhizome. There has been no re-development of the weed in this experimental area.

A small patch of *Datura* in all stages from young seedlings to fully flowering plants was then sprayed, using Methoxone and Weedone. Both weed killers destroyed the young plants, but with mature plants the MCPA was not as efficacious as DCPA. The plants, although distorted, continued to live and developed seed. This seed was collected and failed to germinate. Thus, although seed may develop, it is either non-viable or the germination percentage is very low indeed. This effect has been amply demonstrated in the subsequent development of weeds in the grassed drain, the site of the first experiment. There is no weed growth in any of the treated plots.

It has been suggested that these differential weed killers could be used for the destruction of weeds in pyrethrum. They are differential only as far as grassy plants and others are concerned. Pyrethrum, being a dicotyledon, is sure to be affected. A small weedy block of pyrethrum was taken as the site of the experiment and given the following treatments:—

Methoxone Dust to give applications of 1, 2, and 4 lb. MCPA per acre.

Methoxone Liquid to give applications of 1 and 2 lb. MCPA per acre.

Weedone Liquid to give 1 and 2 lb. DCPA per acre.

The effect of the Weedone was most rapid and striking. Within two hours in the more heavily sprayed plot, pyrethrum plants began to show some distortion. All flowering stems were twisted and buds did not develop. More mature flowers, although their stems were twisted, continued to develop. Methoxone dust, even at the heaviest rate, had little effect; younger growth was distorted, but the plants continued to flower. Methoxone liquid, however, had a very much more marked effect and, in some cases, the plants were killed. Seed was collected from all the plots and subjected to germination tests. With the two lighter applications of the dust the germination of the seed was fair. There was no germination at all in the seed from the plot receiving the heavier dusting. With the liquid Methoxone there was a fairly low germination in the seed from the lightly sprayed plot and no germination at all in the seed from the more heavily sprayed plot. Seed from both the plots receiving Weedone gave a very low germination. Since the pyrethrin content of a pyrethrum flower depends upon the development of the fertilized achene, one must expect that, if these weed killers were used upon pyrethrum, although they may not kill the plants, they will affect the pyrethrin content of the flowers. Further experiments have been planned to elucidate this point.

The general results of the experiments at the Scott Agricultural Laboratories are given in the table below. In this table the common names that have been given have been chosen as the result of asking many people what they call the weeds. Most farmers do not know the botanical names of the common weeds and use English or African names, but there is no uniformity. Often, when discussing weeds with a farmer, it has been found that his "pigweed" is "purslane", a plant of very different characteristics. Acceptance of standard names is strongly urged.

EFFECT OF HORNE WEED KILLERS

Common Name	Botanical Name	Effect	Remarks
Blackjack ..	<i>Bidens pilosa</i>	Killed by 2 lb. per acre. Application.	Lighter applications cause severe distortion; some non-viable seed set.
Pigweed ..	<i>Amaranthus</i> spp.	Killed: sensitive.	
Charlock ..	—	Killed; very sensitive.	
Mexican Mari-gold.	<i>Tagetes minuta</i>	Much distorted and depressed. Killed by heavy applications of spray.	The depression of growth allows grass to swamp the weed. Seed not viable.
McDonaldii ..	<i>Galinsoga parviflora</i> .	Fairly resistant, killed by heavy applications of spray.	Young plants sensitive. Viability of seed reduced.
Datura ..	<i>Datura stramonium</i> .	Young plants killed by 2 lb. per acre.	Old plants severely affected. Viability of seed nil or very low.
Purslane ..	<i>Portulaca oleracea</i> .	Fairly resistant (?)	More observations needed.
Devil Thorn	<i>Oxygonum atriplicifolium</i> .	Depressed.	Flowers, but sets no seed.
Double Thorn	<i>Tribulus terrestris</i> .	Sensitive at all stages.	
Listening Willie.	<i>Commelina</i> spp.	Very sensitive; killed.	
Sorrel ..	<i>Oxalis</i> spp.	Uncertain.	Certain species appear sensitive, others resistant. More observation needed.
Wild Lettuce	<i>Lactuca taraxacifolia</i>	Sensitive.	It appears that the rhizomes are killed as well as the leafage. More observations needed.
Wild Cowpea	<i>Vigna verticillata</i>	Very sensitive; killed.	
Stink Weed ..	<i>Chenopodium botrys</i> .	Sensitive; killed.	
Khaki Weed	<i>Alternanthera repens</i> .	Resistant.	Very young seedlings killed.

It is very evident from the results in this table that much more work on these weed killers is needed. Plans have been drawn up for laboratory and extensive field experiments. At present it is very problematic if their use would be generally economic; one or two special crops, such as pure strains of grass for seed production, may be able to stand the cost.

Field

At the beginning of April the Senior Agricultural Chemist assumed responsibility for the fields at the Scott Agricultural Laboratories. To assist him Major Hewitt, V.C., was appointed at the beginning of May as Assistant Agricultural Officer.

Up to last year, the Scott Agricultural Laboratories' fields were mainly devoted to coffee, but most of the coffee has now been removed and the fields are to be used for general agriculture. Continuous weed cover was employed under the coffee, with the result that the fields are now very full of weeds; reference to the difficulty of establishing grass has already been made above. Certain peculiarities had been noticed in the fields; in some cases there were regular depressions in the growth of the crops. A study of one of the fields led to the conclusion that each of these depressions was the old site of a coffee tree. It was also noticed that where crops liable to attack by eelworm were grown infestation was always worse on the site previously occupied by a coffee tree. It has thus been necessary, as far as possible, to plant crops that would have a cleaning effect upon the land. Many of the fields, therefore, are now down to long period grass crops, *Trans Nzoia Rhodes*, and *Perennial Kavirondo Sorghum*. That these crops do have a cleaning effect is shown in an area that had been under *Napier Grass* for a period of three years. Tomatoes, which are very sensitive to attack by eelworm, planted on this land were absolutely free from eelworm.

In one field which had been planted partly to beans and partly to mustard most peculiar growth was observed. The greater part was very poor indeed, but scattered regularly over the field were patches of heavy, strong growth. In the case of the mustard, samples were taken from the good and the poor growth and then weighed. The weight of individual plants from the patch of good growth was sixty times that of plants from the zone of poor growth. These peculiar conditions are difficult to explain, but, finally, tissue tests revealed that the plants of poor growth were virtually free from phosphate, whereas those in the patches of good growth were full of phosphate. The history of the field was then worked out. About twenty years ago this field suffered from very heavy erosion, one night's rainfall of over seven inches did most of the damage. Since then it has been used for all sorts of experiments in anti-erosion measures and had suffered further sheet erosion, with the result that there was very little surface soil left. This field was then planted to coffee and the surface soil around each of the planting holes was raked into it, together with a small dressing of carcase meal. Each of the spots of good growth had been the site of a coffee tree. This land has now received heavy dressings of silico-phosphate and has been put down to *Rhodes Grass* in an attempt to restore more even conditions of fertility.

Since the control of fields was altered it has been possible to arrange for the planting of experimental crops for the other scientific officers under the best conditions available. Doubtless reports on these crops will be made by those concerned. Experimentation has taken precedence over food production.

The rainfall during the year was apparently not too bad, but when the figures are analysed, it is very evident that a great deal of the rainfall was non-effective. It reduced a total rainfall of 31 inches to an effective rainfall of about 24 inches. In determining the effective rainfall, light falls in a dry period or even falls up to half an inch have been disregarded. For example, in March the total rainfall was 0.98 inches. Apparently, quite a nice rain—in fact, half an inch fell at the beginning of the month after three weeks of dead dry weather. This was followed by two very light showers and then a week's hot, dry weather. This half inch moistened the soil to a depth of a little over an inch, but quickly evaporated. Subsequent falls in March were also light and were immediately lost by evaporation. Examination of the rainfall table, therefore, indicates that the so-called "long rains" were of very little value indeed, and it is not surprising there were many crop failures. From August onwards, however, we had a good season.

RAINFALL TABLE

<i>Month</i>		<i>Actual</i>	<i>Effective</i>
January	.. ..	0.18	—
February	.. ..	0.28	—
March	.. ..	0.98	—
April	.. ..	4.32	4.20
May	.. ..	4.74	3.75
June	.. ..	0.24	—
July	.. ..	0.47	—
August	.. ..	2.81	1.87
September	.. ..	4.41	3.67
October	.. ..	6.40	5.30
November	.. ..	3.71	3.35
December	.. ..	2.51	2.28
Total	..	31.05	24.42

Crops*Mustard*

There is an unsatisfied demand for mustard to-day. That mustard is a likely crop for East Africa has long been recognized, and certain Agricultural Officers have already tried it, notably the late Mr. Ball. When, at the beginning of the war, one of the big mustard firms inquired into the possibility of mustard being produced in Kenya, Mr. Ball was consulted, he stated that every one of his trials had been a failure owing to intense attack by insects, notably flea beetle, in the seedling stage and sawfly later. In the new insecticides that are available, it appeared that possibly Gammexane might provide a solution to the insect trouble. Mustard is a quick growing crop and it would be difficult to keep all the growth covered with a protective film of insecticide. Gammexane, however, is fairly persistent and somewhat volatile; it is not as persistent as D.D.T. because of its volatility, and it was considered that perhaps the volatility would provide a protective vapour in the new growth. Arrangements were therefore made for trials to be laid down at the laboratories and at several of the up-country stations.

At the Scott Agricultural Laboratories both black and white mustard were sown in widely separated plots. As soon as the seedlings appeared it was noticed that there were many flea beetle present. The plots, with the exception of the two windward rows in each, were dusted with a diatomite dust containing five per cent of BHC-O .65 per cent Gammexane. Subsequent to the dusting, it was observed that damage had ceased and very large numbers of dead beetles were collected around the rows. Sawfly soon appeared in large numbers, but no larvæ were observed. A fortnight later there was a period of heavy rainfall, which washed the dust into the soil. Although there was no dust visible, the odour of BHC was readily detected. It was felt that perhaps it would be safest to apply more dust. That night there was a further rainstorm, which washed all the dust off the leaves. Nevertheless, although there were hundreds of sawflies on each of the plots, there was no damage, but it was noted that within a few minutes of settling on a leaf sawflies became "dopey" and often fell to the ground. At about the time of flowering it was noticed that insects were beginning to damage the leafage and a third application was given, which protected the plants. A month later, owing to attack by moth caterpillars, a pyrethrum dusting was given. This protected the crop, up to its ripening, against insect attack. It, however, suffered severely from the depredations of birds.

This apparent fumigant effect of Gammexane is a matter of great interest, and further experiments have been planned to ascertain whether there is really a true fumigant effect.

At the up-country stations insect infestation was much lighter than at the Scott Agricultural Laboratories, and it is highly probable that these frequent dustings will not be necessary.

Spice Seeds

Before the war Britain and, to a large extent, the United States, obtained their supplies of what can only be called "spice seeds" from Central Europe. Under this heading are such seeds as Dill, Coriander, Caraway, Aniseed, etc. Some of these do well in Kenya, and it appears that the production of these may prove a highly desirable sideline in farming economy.

In the moister areas the flowering heads of Dill are attacked by a fungus which prevents seeding without destroying the head. Seed has been planted at the Scott Agricultural Laboratories, and it is found that the flowers are free from attack. A larger plot was established during the year but too small, however, to obtain any measure of yield per acre. The plant has flowered well and sets seed profusely as long as conditions are not too dry. It also appears to be almost a perennial plant. It is considered to be a promising crop, and it is hoped that by the end of next year a fair amount of seed will be available for distribution.

There are two strains of Coriander. One is the ordinary Indian strain, a rather large seed, very pungent and much used in curry powder. The other is the English or European strain, which produces a smaller seed of a much more delicate flavour. While there is a big demand for both types, the demand would probably be greater for the English strain as its essential oil is used in perfumery. A fortieth of an acre plot was planted in August. It grew rapidly and yielded $14\frac{1}{2}$ lb. of seed, that is at the rate of 580 lb. per acre. At the same time, there was a very great deal of shattering. Perhaps earlier reaping of the ripening heads would have ensured the full crop. At this rate of production, it appears to be a highly promising crop. Its cultivation will be continued in the next year and trials will also be made of the Indian strain.

Normally speaking, the true Caraway is a semi-perennial, but an annual strain has been developed in the U.S.A., the seed of which has recently been imported. This has done very poorly indeed, but a small amount of seed has been reaped. It is being planted again next year in the hope that it will have become acclimatized. Cumin seed was obtained from Cyprus. This, too, has been a failure. In the open the growth is very slight and the plant appears to be highly appreciated by insect pests. Under shade in the nursery, a small plant is produced, which seeds very early and very shyly. Possibly, here too, acclimatization is necessary. Another failure is Aniseed. Possibly this crop requires a cooler climate.

Essential Oils

The essential oil plot has been established for a good many years. Fresh planting material was propagated and the whole plot dug up and new stock has now been established, from which planters will be able to obtain the necessary planting material.

Cereals

Both Muratha and a yellow maize were planted during the "long rains". While vegetative growth was very promising, the weather was very dry at the time of tasseling. Careful inspection of the fields, in one of which a manurial experiment had been laid down, revealed that not a half per cent of the plants showed

promise of cob production. The standing crop was, therefore, sold for fodder. Several American-Indian strains of maize were put under trial. The growth of most of these was rather poor, but one, Mais del Pais, showed promise and was replanted in the "short rains"—unfortunately in the field exhibiting phosphate deficiency. Although growth was very poor, the yield was sufficiently promising for it to be decided that this strain will be grown again in the coming year. An American Sweet Corn was also tried, but although cobs were produced, the return has been so poor that experiments with it are not being continued.

Much interest, probably as a result of articles in the magazine, *The Reader's Digest*, has been shown in hybrid maize. In all probability, people have not realized what is hybrid maize. It is a well-known fact in plant breeding that the first generation after hybridization between two pure lines is more vigorous and heavier yielding than either of the parents. In the development of hybrid maizes pure lines, specially selected to suit the local conditions, are established, and these are crossed. Whether the pure lines are suited to our conditions is a moot point. Five varieties were planted towards the end of the short rains at the Scott Agricultural Laboratories. The results of this planting will not be available until next year. Three, however, appear to find our local conditions to their liking.

As one of the fields was showing signs of eelworm infestation, it was planted a second time to a cereal crop during the short rains, in this case, Maltworthy Barley. The growth has been very satisfactory up to the time of reporting.

Pulses

Two variety trials on Beans were planted during the year. During the long rains season varieties Canadian Wonder, Plentiful, Granada, Michelite and Navy were put on trial. Plentiful gave the best growth, followed by Canadian Wonder, while Michelite and Navy had the typical haricot bean type of growth. As regards yield, Canadian Wonder yielded significantly better than the rest; Plentiful significantly better than the two haricot types. It appears that our old Canadian Wonder bean is still one of the best varieties of dried beans. During the short rains a very much larger variety trial was laid down, but, unfortunately, this was on the phosphate deficient plot, as were also a number of new varieties supplied by the Uganda Department of Agriculture. Sufficient seed, however, was reaped for multiplication next year.

A white variety of Soya Bean was planted as a cover crop on one of the fields and yielded well. Ripening, however, was most uneven. Four wilt-proof strains of Pigeon Pea were also planted on behalf of the Senior Plant Pathologist.

Quinoa

Some years ago the late Mr. L. A. Elmer carried out a campaign to popularize the South American food grain, Quinoa (*Chenopodium quinoa*). A certain amount of interest was shown in this grain, but little has been heard of it in the last few years. At the beginning of this year the Agricultural Adviser to the Colonial Office sent out a quantity of Quinoa seed supplied by Kew, stated to be a very fine strain of the white variety. This was planted at the beginning of the long rains. The germination was very poor indeed. A very fair proportion of the plants was bright purple, showing that the strain was not pure—plants that started grew very well and stood up to the drought that followed the very poor rains. The seed heads were very large, too large, in fact, for the root growth which probably had been damaged by insects. A very fair quantity of seed of both the white and purple types was obtained from the plants that survived. Seed was again planted when the short rains started. The seedlings, however, proved to be very sensitive indeed to drought and died off before they were really established. No further seeding has been made this year, but the crop will be tried again in the coming year.

Oil Seeds

In view of the very great demand for oil in the world to-day, experiments have been carried out on the growth of possible oil-producing crops. A small quantity of safflower seed was obtained from a local planter. Some years ago Safflower was tried on a very large scale, but owing to the very low price for oil seeds that then obtained most growers gave it up. It has done very well at the Scott Agricultural Laboratories during the short rains and yielded at the rate of 1,740 lb. of seed per acre. The oil content of the whole seed was 28.5 per cent, which equals 67 per cent on the basis of the kernel. This oil content is very satisfactory indeed and compares well with the world's average. The crop will be grown on next year for multiplication, so it may be possible to make a small issue to those interested. At the beginning of the war a small quantity of Hungarian linseed was handed to the writer. This was sown in small plots so as to maintain the strain. Before the long rains a small plot was sown, and although climatic conditions were very bad indeed it produced quite a passable crop, but very unevenly. The seed from this plot was sown again during the short rains. The growth was very satisfactory indeed, and three small plots of one-fortieth of an acre were cut out of the area under the linseed. These averaged 11 lb. each and corresponded to the yield of 440 lb. per acre—a disappointing yield. Much of the seed, however, was lost by shattering. Possibly under more suitable conditions this linseed would be worth growing.

Miscellaneous Crops

Again, because of articles in *The Reader's Digest*, there has been great interest in Kudzu. Kudzu has been grown at these laboratories for the last twenty odd years and has not impressed us. Under our conditions, it is necessary to propagate cuttings in the nursery and then to plant them out at the beginning of the rains. Nine cuttings were planted out at the beginning of the long rains in a plot that received silicophosphate at the rate of 400 lb. to the acre, American work having shown that for the successful establishment an ample supply of phosphate is necessary. It is claimed that Kudzu is very highly drought resistant and will establish itself under very hard conditions. Development in the first five months after planting was practically nil, and it was only in November that the plants began to put out strong shoots. The growth at the end of the year was far less than that of an ordinary crop of beans. It must be accepted that for most conditions in Kenya, Kudzu is not the wonderful plant it is claimed to be.

In the drier parts of South Africa and Australia cattle melons are grown as an insurance against drought. Immense quantities were often stored in piles, where they last for three to six months in perfect condition. A small quantity of cattle melon seed was available and was planted out at the beginning of the long rains. Although it is a true dry land plant, growth was most disappointing, and from about a dozen plants six small melons were reaped. Seed from these, however, was planted out in the short rains with very different results. Growth was strong and that a heavy crop will accrue was evident by the end of the year, some of the melons being of large size. Possibly the seed has now been acclimatized. It will probably prove a useful standby in the drier stock-raising parts of the Colony.

V. A. BECKLEY,
Senior Agricultural Chemist.

ANNUAL REPORT OF THE SOIL CHEMIST, 1946

In March Mr. G. M. F. Grundy, B.Sc., was appointed as Laboratory Assistant in the Chemical Section and has been assisting the Soil Chemist with analytical work. In July the African Agricultural Laboratory Assistant, who over many years had been trained to carry out certain routine analyses, resigned as he was able to obtain a better paid post outside Government service.

A record total of 662 samples of soils and 92 other samples, mainly manures and fertilizers, was dealt with. Of the soil samples 442 were taken and analysed in connexion with soil survey and investigational work and the remaining 220 samples were received from Agricultural Officers and direct from farmers in connexion with advisory services. During the year field work has been limited to regional land utilization surveys and it has not been possible to visit individual farmers as in the past.

Whenever possible, farmers are again advised to bring representative soil samples to these laboratories so that the Soil Chemist can discuss their problems with them and give advice accordingly. When this is not possible, then separate, representative composite soil samples of any particular soil conditions should be submitted, together with information about the depth of sampling, the nature of the soil profile or at least of the immediate sub-soil, the drainage conditions, history of crop performance, past manuring and whether any particular information is required. Whenever large numbers of soil samples have to be examined for their manurial requirements, it is advised that these be dispatched to the Scott Agricultural Laboratories at least one month before seeding time.

Investigations

Investigational work on soils and fertilizers cannot conveniently be classified under particular crop headings. Such work has application to certain soil types and their treatments wherever they occur.

Soil Survey

Though no time has been devoted to a special study of the classification and distribution of natural Soil Series, the opportunity has been taken to collect data on the morphology of soils and Climatic Soil Groups while carrying out land utilization surveys. In fact, land utilization surveys are mainly based on an initial classification of soils into natural Soil Series, special attention being given to soil fertility factors such as drainage, soil structure, organic matter content, nutrient and base status and soil reaction values. Similar natural Soil Series can be grouped together according to their potential agricultural value, taking note of the natural vegetation and an estimate of the rainfall and its distribution.

New Soil Series comprise very deeply weathered residual soils derived from gneiss and schists, naturally well-drained ancient alluvial deposits now laterized, shallow black loams derived from basic lavas, skeletal soils derived from recent volcanic ash, grey-black and black heavy loams with impeded drainage over calcareous, heavy sub-soils derived from basic lavas; grey-black loams over rust and black mottled grey-brown clayloams over grey-black very impervious clays derived from old alluvia. In the Tana region a wide range of new Soil Series and Climatic Soil Types formed under desert conditions has been recorded. Of greatest interest is a shallow, desert, ochre-red sandy soil overlying a secondary calcareous horizon at two to three feet, derived from a calcareous red and white marbled sandy clay deposit. The gradual accumulation of information about Climatic Soil Types will be useful when the time comes to classify and map the Major Soil Groups that obtain in Kenya and in East Africa. A register is kept of all Soil Series classified.

Land Utilization Surveys

Land utilization surveys vary in intensity with the use that can be made of the land. In the extensive arid areas it takes the form of a reconnaissance survey only, taking note of the main soil types and their inherent fertility, water supplies, the natural vegetation and the estimated rainfall and stock carrying capacity of the land and, at the same time, a search is made for any local areas where some irrigation is possible. Where the rainfall permits one or more crops per annum, survey is more intensive and a system of soil and land classification and an estimate of the human and stock-carrying capacity of the land is worked out. In the case of irrigation schemes much more detailed soil survey work is necessary, special attention being given to topography, the depth and nature of the soil profile, drainage, nutrient status and the amount and nature of salts present in the soil and sub-soil. The soil conditions are studied to a depth of at least four feet.

The first type of reconnaissance survey has been carried out over certain lands in the Makueni, Kibwezi, Simba and Chyula regions, the western portion of the former area having relatively better soils and a higher rainfall.

In the Makueni region there are locally elevated areas carrying shallow and often eroded soils derived from granite rock and much larger areas of deeply weathered and reassorted soils derived from gneiss and schists. The nature of the soil profile is largely governed by local topography, the more fertile soils being dark brown and reddish-brown loams occurring on more level land below steeper slopes. The critical factor limiting settlement is whether the rainfall and its distribution over a number of years in this warm region, situated at an elevation of 3,200 to 3,800 feet, is adequate to ensure that there will not be too many crop failures. Cultivation would have to be confined to selected sites in the western portion and anti-erosion and good farming measures would have to be instituted from the start as, with cultivation, many of the present virgin soils would deteriorate rapidly and become subject to serious accelerated soil erosion.

North of the Mbuini River in the Simba region the average soil conditions are less good than in Western Makueni, as there is a greater proportion of highly coloured, sedentary, reddish sandy loams to loams carrying a more scanty vegetal cover. Even with the provision of water supplies and much bush clearing this area would only be suitable for extensive stock ranching. At Nguu there is a series of volcanic hills where the basalt rock has given rise to shallow, stony soils on the slopes, but lower down there is a wide belt of a greyish-brown clayloam, extending almost to the Ithumba stream, which carries good natural grazing. Again, in the vicinity of Simba, there are other better red plain grassland soils. These two land types comprising a total of about 6,000 acres, situated not distant from the Simba Springs, would need very little clearing and are suitable for settlement based on stock.

In the Kibwezi region most of the more level land has reddish, brownish-red, and greyish-fawn loamy sands to loams of low fertility derived from granitic gneiss. Better reddish-brown, deep colluvial soils occur round Mbwinzau, and in between the several small knolls to the north-east and there are other better soils near the Kibwezi River. Eastwards towards the Athi River the soils become more highly coloured and less fertile and the rainfall also decreases as shown by the gradual change in the nature of the vegetation. In the south-western portion there are recent lavas with shallow, stony soils of no agricultural value. One feature noted at Kibwezi was that when the soils were cultivated even for a very short period they were slow in regenerating a natural cover. The soils are very liable to serious erosion during the time when they are almost bare of cover. Apart from

irrigation from the Kibwezi River, this region is only suitable for stock ranching with a limited amount of cultivation in the vicinity of Mbwinzau and near the river.

During the reconnaissance survey of the Chyulu region of some 1,000 square miles the lower limits of the recent Chyulu basalts, carrying very shallow and stony black loams with much bare rock and boulders, of no agricultural value, were approximately mapped over a distance of about thirty miles. This survey showed that these useless lands extended over about two-thirds of the Chyulu area to the north of Mteito Andei. To the north-east beyond the lava flow the main soil types derived from Basement Complex rocks are deeply weathered, reddish-brown and greyish-brown sandy loams with local areas of shallow, more highly coloured, sandy soils. There are about 120,000 acres of land suited only to extensive ranching to the north of Mteito Andei River, and south of it there are a further 200,000 acres with a rainfall of 15 to 20 inches that have a very low ranching value. There are better soils with more natural grazing to the south of Makindu, near Makindu Springs and in the higher Masongaleini country. The only lands suitable for cultivation in the Chyulu area are some soils derived from volcanic ash that overlie the hard lava at the base of the Chyulu Range. Here, at an altitude of 3,500 to 4,000 feet, there is a belt of deep, juvenile, dark brown, almost neutral light loams carrying an Orchard-Grassland cover with much oat grass. The soil is rich in organic matter (.26 per cent total N) and in all plant nutrients. With the conservation of storm water from off the Chyulu Hills it would be possible to have settlement based on stock and cultivation on selected sites. From one vantage point only it was estimated that there were at least 1,000 acres of land suitable for cropping and a further soil survey along the base of the Chyulu range is suggested.

Sixty-two soil samples were taken and analysed in connexion with the above surveys.

When carrying out the reconnaissance survey of the Chyulu area the opportunity was taken to examine the possibilities of an irrigation scheme based on the permanent flow of the Mzima Springs of about 100 cusecs which enters the Tsavo River about 40 miles upstream from its confluence with the Athi River. Suitable site and soil conditions for irrigation occur on the right bank of the Tsavo just below where the spring waters enter the river. At least 800 acres of suitable soils could be commanded upstream from the old bridge and there were indications of more suitable land further down on the right bank.

Trans Mara.—A more intensive land utilization survey has been carried out over the Trans Mara district of about 1,100 square miles, situated at an altitude varying from 4,800 to 7,000 feet and with a mean annual rainfall ranging between 40 and 60 inches, as the larger portion of this district is suitable for cultivation and close settlement. Trans Mara has a wide range of different geological, topographical, climatic and soil conditions which give rise to distinct "land types" suited to different forms of land use. There are about 240 square miles of a southern extension of the Kisii Highlands rising to 7,000 feet and with a good rainfall. The volcanic and quartzite rocks have weathered into deep, well-drained fertile soils. Southwards there is some broken country with parallel ridges of hard lava with much shallow soils and, again eastwards, there is a large expanse of gently sloping and undulating granite country with deep, greyish-black fine sandy clayloams with slightly impeded drainage and carrying a "parklands" type of vegetation. In the upper Migori Basin there is much wettish old alluvium. To the south of Lolgorien there is slightly sloping and undulating land situated at 5,000 to 6,200 feet carrying well-drained, reddish-brown, chocolate-brown and almost black fertile sandy loams to loams derived from granite. To the east, above the

Isuria Escarpment, the granite is overlaid by a hard phonolite which has given rise to deep, naturally well-drained chocolate-brown loams on sloping land and greyish-black clayloams in the more extensive areas of very gently undulating grassland plains with clumps of trees and bush.

Except for some bad gully erosion caused by cattle tracks in the area of deep, volcanic soils in the southernmost corner, Trans Mara has virgin soils carrying indigenous grasslands, parklands, and dense bush often approaching forest, and there has been a very little accelerated soil erosion. The climate, soils and natural vegetation over most of Trans Mara are in sharp contrast to the conditions met with in the low-rainfall regions referred to earlier in this report. Over most of the district the rainfall and its distribution and the presence of fertile virgin soils permit of intensive cultivation and provide good grazing lands.

The area has been classified into seven Land Types, which have been described and suggestions made for their utilization. About 200 square miles will require drainage before the land can be used to advantage.

It is estimated that, following clearing and the provision of water supplies in certain areas, some 14,000 families could be settled in the Trans Mara. With land drainage and an increase in soil fertility and with more intensive methods of farming, it is likely that at least 20,000 families could be settled under a conservative method of farming without undue strain on the land.

Fifty soil samples from nineteen representative soil profiles were taken and analysed in connexion with this survey.

Tana River Irrigation Project.—A reconnaissance survey was carried out over about 4,000 square miles of the Upper Tana Basin extending up to 30 miles from the river on the left bank and up to a maximum of about 60 miles from the river on the right bank between the vicinity of Balambala and Bura.

The survey showed that there was much broken country and shallow eroded soils, more especially in the upper portion of the right bank of the river, and that sufficient land with a suitable topography and depth of soil for irrigation only occurs from below about Rahole on the left bank and to the south-east of Giraffe Pool on the right bank. Field and laboratory work made it possible to classify seven main soil types noted in the area surveyed. These soil types are described and their location and approximate extent indicated, and a further account is given of unclassified soil conditions and their distribution. This work involved the taking and the laboratory examination of soils from 65 soil profiles, which data was used to classify the soils and to judge their relative value for cropping under irrigation. Laboratory work included the determinations of texture, natural drainage constants, soil reaction values, water-soluble salt content and phosphate status for 140 separate soil samples and the total nitrogen content of 24 deep surface soil samples. Under the present very scanty natural vegetation in this semi-desert region all the soils are exceedingly low in reserves of soil humus and nitrogen (.02 to .03 per cent total nitrogen), and there are no soils of sufficiently high inherent fertility that would warrant proceeding now with detailed survey work. The most likely potentially suitable soils occur on the peneplain off the left bank of the river. Four of the main soil types occurring in this region have been used for pot culture work and, in all cases, these trials show that there is a marked deficiency of available soil nitrates. This work, coupled with the previous analysis, confirm that untreated soils are not sufficiently fertile for cropping. However, the soils are low in one essential nutrient only, namely nitrogen, and it is possible that the humus and nitrogen content of the soils could be built up by leguminous green manuring and cover cropping under irrigation. Further pot culture trials were made to note the effect of such a treatment and also of an abundant supply of

nitrogen only on the crop carrying capacity of these soils. In the case of all four soils tried out, the incorporation of a large amount of nitrogen-rich, green manure, *Glycine javanica*—containing 2.63 per cent total nitrogen on dry matter basis—resulted in a more vigorous and healthy growth of maize and millets for ten weeks, after which period nitrogen deficiency symptoms again appeared. The third treatment, supplying ample amounts of nitrogen only in the form of ammonium nitrate, has resulted in continued very healthy growth. These tests indicate that the only need of these semi-desert soils is extra nitrogen and suggest that these apparently infertile soils could be made productive by appropriate systems of rotation and manuring under irrigation. It is essential that an irrigation experimental station be established to give sound information on the relative suitability of the most promising soil types; on the degree of improvement in crop production that can be brought about by good soil management and on the drainage needs of some of the heavier soils.

The Manufacture of Silicophosphate

Analyses, pot culture work, and field experiments have shown that silicophosphate, with a low water-soluble but high citric-soluble content of P_2O_5 , prepared by calcining Uganda Rock Phosphate with Magadi Ash, constitutes a very suitable form of phosphatic fertilizer for local soil conditions. There are technical difficulties in the synthesis of silicophosphate in a large plant and reliable manufacturing firms are unable to start building such expensive plants until further research work on commercial production methods has been carried out. The present position is that although it has been shown that a suitable phosphatic fertilizer can be prepared from local raw materials and farmers are pressing for its early mass production, commercial production has to be postponed. However, as far as the European areas of Kenya are concerned, there is no need to wait for a uniform, high grade product, as the process of manufacture is simple as long as we are not concerned with damage to an expensive plant and are prepared to use a material with a somewhat varying degree of conversion into the "citric-soluble" form. During the year laboratory work and co-operative trials with certain farmers have been carried out on practical methods of preparing silicophosphate by simple means on individual farms or communally. Standard proportions of Uganda Rock Phosphate and soda mixed with a minimum amount of water are moulded into units suitable for handling, drying and burning, the formation of crystals of soda cementing the material together. Some of the difficulties that have to be overcome are slow drying, disintegration during drying, and collapse and low degree of conversion with kiln firing. Some of the laboratory findings are as follows:—It is better to use highest grade ore and to mix 100 parts of ore with as many parts of commercial Magadi Ash as the declared phosphoric oxide content of the milled ore used and to mix with the minimum amount of water which will not be more than 15 per cent by weight of the dry mix. Bricks must be shade dried so as to avoid disintegration when recrystallization is brought about by intermittent heating in the sun and cooling by night. As small units dry and are converted much quicker than larger ones, it is a great advantage to lessen the maximum distance from the inside of a brick to the surface by having ventilation holes made through the bricks by leaving a couple of one inch pegs in the newly-made bricks and then withdrawing them after four to six hours when the bricks are partly set. Two openings made in standard size bricks reduce the time of drying by almost half and make for a more rapid and uniform burning with a higher degree of conversion and, should the material be overfired and partly sintered, then crushing is also easier. It will be found that bricks have sufficient strength for burning when they have lost about seven per cent of their original weight when they can be fired without the danger of collapse in the kiln. When drying is slow in wet weather, shade dried bricks prepared two days previously

could be heated in single layers over a cool fire for two to three hours such that the outside is hard and the inside dry and crumbly, but still weak. These partly burnt bricks can then be stacked ready for burning or stacked directly into the kiln. For the same batch of milled ore colour offers a good clue as to the degree of conversion. It darkens from rusty red to chocolate-red, then black and finally grey-black. There is no need to burn beyond a lustrous black colour, as the grey-black material produced with further heating has no higher degree of conversion and, furthermore, it is more difficult to grind. So far, no kiln-burning trials with heaped bricks have been undertaken, but the findings listed above should form a useful guide when this necessary further work has to be undertaken. Certain farmers have started kiln-burning trials on a small scale with some success, but further information is needed on the optimum size, shape and height of kiln or clamp, the size and shape of the units, the best method of packing, and the time and temperature of firing that gives the optimum economical degree of conversion.

Periodical analyses have been carried out on samples of silicophosphate and silicophosphate Uganda Rock Phosphate mixtures to note any changes that take place on storage. A sample of silicophosphate with 16.3 per cent citric-soluble P_2O_5 and 1.05 per cent of free sodium carbonate was used to prepare material with low, medium, and high amounts of free sodium carbonate. These treatments gave a material with .47 per cent, 1.05 per cent and 2.0 per cent of free sodium carbonate. After six months of storage there was no appreciable difference in the amount of reversion that had taken place, the final amounts of citric-soluble P_2O_5 being 15.7 per cent, 15.5 per cent and 15.6 per cent. This showed a loss of about six per cent of the original citric-soluble P_2O_5 . The presence of more free soda did not reduce the small degree of reversion that takes place on storage. When two mixtures of silicophosphate and Uganda Rock Phosphate giving 10 per cent and 15 per cent respectively of citric-soluble P_2O_5 were stored for eight months there was a similar small loss of citric-solubility.

G. H. GETHIN JONES,
Soil Chemist.

ANNUAL REPORT OF THE SENIOR ENTOMOLOGIST, 1946

Staff

Mr. H. Wilkinson was on leave pending retirement until 29th March, 1946, when he retired after many years' service with the Department.

Dr. R. Le Pelley was Ag. Senior Entomologist until 29th March and was appointed Senior Entomologist, with effect from that date. He was on duty until the end of the year, being occupied both on general entomology and as a member of the East African Anti-Locust Directorate on locust work.

Mr. C. F. Fox, A.A.O., was on duty throughout the year, being largely occupied with the increasingly heavy work of the Plant Protection Ordinance.

Mr. R. G. Smith, Junior Laboratory Assistant, returned to the section on release from H.M. Forces on 16th April, 1946, and resigned his appointment with effect from 1st January, 1947.

Plant Protection

The only new legislation under the Plant Protection Ordinance was in connexion with Maize Stalk Borer, and will be detailed under that heading.

Due to the change to peace time conditions, there was a marked increase in the importation of plants, as indicated by the fact that while 190 plant importation permits were issued during 1945, 439 permits were issued during 1946.

In connexion with the importation of plants, the measures taken to close various loopholes, whereby pests and diseases might enter the Colony, have had a large measure of success and the co-operation of the Chief Grader and Inspector at Mombasa and the Post Office Authorities and H.M. Customs throughout the country to this end are gratefully acknowledged. At the end of the year negotiations were still in progress with Tanganyika Territory to prevent the importation through Tanganyika into Kenya of plant products from outside East Africa. This important channel, whereby pests and diseases might be introduced into Kenya, will be closed, and it is hoped that this will be achieved in 1947 with a satisfactory agreement with the Tanganyika Government and Railway.

The prohibition of importation of herbaceous ornamental plants in a vegetative condition in order to avoid the introduction in such plants of the tomato spotted wilt virus disease was continued throughout the year and, at the instance of this Department, Tanganyika Territory and Uganda also agreed to enforce the same prohibition. Since each country now bans the importation of herbaceous ornamental plants in a vegetative condition from all sources outside East Africa, permits for the movements of plants between the territories, subject only to any restriction for other reasons, can be issued. The action of Uganda and Tanganyika Territory in agreeing to enforce this measure is very much appreciated. It is a valuable example of inter-territorial co-operation for mutual benefit.

The importation into parts of Tanganyika of planting material from Kenya has for a long time been prohibited on account of the danger of thereby introducing the coffee mealybug *Pseudococcus kenyae*. The complete ban has been recently removed, and it is understood that permits will now be issued by the Tanganyika Territory Authorities for plants from Kenya subject to certification by this Department that they have been suitably fumigated. At the end of the year arrangements had been made for the erection of a fumigation chamber for this purpose and for the fumigation, where necessary, of imported plant material.

Inspection Service

Exports.—There was a drop in the number of packages of plants examined for export from the Colony. Sixty-four packages were examined and 56 certificates issued. The items numbered about 1,600.

Imports.—There was a large increase in the number of plants imported and inspected on arrival; part of this work was done at Mombasa and part at Nairobi. The fruit trees imported were inspected at Nairobi and the work of inspection and reconsigning of very large shipments was heavy in August and September. The exact number of trees examined is not known, but 11,053 trees arriving in Nairobi by rail were examined, together with several thousand plants arriving by post and by air. A total of 15,000 plants inspected is probably an underestimate.

The inspection of fruit trees at Nairobi was a war time innovation introduced because of the difficulty of war time transport and delay in transmission of certificates. It was never intended that this would be permanent, since it is undesirable that pests and diseases should be actually imported into the country before inspection takes place, and in consequence it was decided, late in the year, that all plant importations, including fruit trees arriving by ship at Mombasa, would in future be inspected there.

Insects intercepted.—A number of insect pests and plant diseases were intercepted both on fruit trees and other plants and also in parcels of seeds. Some fruit trees were so heavily infested with scale insects as to leave no alternative but destruction of the trees.

The following insects and diseases are among those intercepted, the majority of which are not identified to species:—

Red Scale—*Aonidiella aurantii*—on citrus—ex South Africa.

Mealybug—*Pseudococcus* sp.—on citrus—ex South Africa.

Coccid—*Icerya* sp.—on citrus—ex South Africa.

Ant—*Pheidole megacephala*—nests in roots and in packing of trees—ex South Africa.

Scales—*Saissetia* 2 spp.—on citrus—ex South Africa.

Lygæid—on peach fruit—ex South Africa.

Dermaptera—1 sp.—on peach fruit—ex South Africa.

Psocidæ—in packing material of trees—ex South Africa.

Collembola—in packing material of trees—ex South Africa.

Staphilinidæ—1 sp.—in packing material of trees—ex South Africa.

Snails—in packing material of trees—ex South Africa.

Slugs—in packing material of trees—ex South Africa.

Canker—on twigs citrus—ex South Africa.

Diptera—1 sp.—on bulbs—ex India.

Lepidoptera—1 sp., larvæ of—on seeds—ex India.

Coleoptera—1 sp.—on seeds—ex India.

Hymenoptera—1 sp.—in seeds of apple—ex France.

Diptera—2 spp., larvæ—in packing material of beech trees—ex England.

Slugs—in packing material of beech trees—ex England.

Snails—in packing material of beech trees—ex England.

Earth Worms—in packing material of beech trees—ex England.

Slugs—in packing material of strawberry plants—ex England.

Worms—in packing material of strawberry plants—ex England.

Coleoptera—1 sp.—in grass seed—ex England.

Coleoptera—*Bruchus* sp.—in beans—ex England.

Weed seeds were intercepted in many parcels of seeds and, in some cases, the proportion of weed seeds was such as to entail the prohibition of importation of the consignments.

A large number of herbaceous ornamental plants, particularly bulbs imported without permit, were intercepted, and these were either re-exported or destroyed. Despite frequent publication in the Press, the ban on these plants does not yet appear to be generally known. Nevertheless, the knowledge is growing and in

cases where such plants have been introduced unwittingly, on explanation being given of the reasons for the ban, there has been cheerful acceptance of the necessity for individual compliance in the interests of the community.

The growing co-operation and friendly understanding of the public in the difficult work of plant protection is gratefully acknowledged, but many breaches of law requiring permits to be applied for in advance still occur, and it is sincerely hoped that these cases will decrease, otherwise it may be necessary to take more drastic action when plant material arrives without a permit, since the increasing volume of plant imports makes the risk now greater than it was.

Another minor but valuable change in procedure arranged during the year was made by agreement with the Imports Controller whereby, to simplify control, the Plant Importation Permit issued under the Plant Protection Ordinance serves the purpose also of the Import Licence in respect of plants, plant products and seeds from South Africa, England, Australia, India, Zanzibar and Nyasaland. This avoided the necessity for members of the public to apply to two separate offices for permission to import plants from those countries. Importations from countries other than those listed was still subject to obtaining an Import Licence from the Imports Controller, in addition to the plant importation permit from this Department.

The acknowledgments of this Department are due to the Postal and Customs authorities for their helpful co-operation, and I also acknowledge with thanks the helpful co-operation of my colleague, the Chief Grader and Inspector, in matters concerned with the importation of plants.

General Advisory Work

Ninety-seven items, either insect pests or infested plant material sent to the laboratory, were examined and reported on. Advisory visits were paid to a number of farms and plantations, and a large number of visitors seeking advice on insect control visited the laboratory.

Maize Stalk Borer

Legislation

In last year's report it was stated that, at the end of the year, plans were in hand for an investigation of the stalk borer position in the Trans Nzoia and Uasin Gishu early in 1946.

In February a visit was paid to these districts in company with the Senior Agricultural Officer, Kitale, to investigate the position. The severity of the infestation was evident, and it was clear also that, in all probability, restriction of planting dates would prove of value. Meetings of the Production Sub-committees for the Trans Nzoia and Uasin Gishu were attended; the position was described and discussed and control measures given. The question of whether or not planting dates should be legally restricted was left to the decision of the sub-committees, and both sub-committees freely agreed not only to ask for the planting dates to be restricted, but to ensure, in so far as possible, that all farmers and squatters should observe them. The value of Production sub-committees is evident in such a case of insect control, which depends on co-operation of all farmers for the benefit of the district in general. The co-operation of farmers, in fact, proved excellent and very little or no maize was planted later than the final planting date.

The two Government Notices in this connexion were Government Notice No. 243 of 1st March, 1946, which added the districts of Uasin Gishu and Trans Nzoia to the schedule of the principal rules, and Government Notice No. 244 of 1st March, 1946, which specified the first day of June, 1946, and the 14th day of February, 1947, as the dates between which the planting of maize was prohibited in those districts.

The value of the restriction of planting dates was clearly brought out by observations on a small patch of maize planted out of season in August, which had an infestation amounting to an average of more than 40 stalk borer larvæ to each infested plant. If these larvæ had been allowed to mature into moths this would have constituted a very heavy carry-over in the area.

Control Measures

Direct control measures are often required and in the past top dressing with a derris extract has been the standard method used. Owing to a shortage of derris during the war alternative chemicals have been sought, and of these sodium fluosilicate and D.D.T. have both been used effectively in South Africa. In 1946 several experiments with sodium fluosilicate were carried out, and a large number of farmers also used the material. The treatment consists of placing a tablespoonful of liquid consisting of 5 oz. sodium fluosilicate in 16 gallons of water into the funnel at the top of each infested plant when between one and three feet high. The solution sometimes results in a scorching of the plant, but this is of little consequence, and the treatment is effective against stalk borer. A preliminary experiment was also carried out with D.D.T. This at five per cent had been recommended as an effective treatment in South Africa, and it was decided to try a lower strength here. A mixture of one part of D.D.T., with 99 parts of local diatomite, was used, and approximately one-fiftieth ounce of this dry powder was used in each infested plant and proved effective in the trial.

The application of a dry powder is much simpler than of a liquid, and this experiment was considered to be of great promise. It will need confirmation on a larger scale before it can be recommended as a field control measure, and arrangements were in hand at the end of the year for these trials to be carried out during the next growing season.

The results of an experiment with three different chemicals against stalk borer are given below:—

	Number infested in 2,000 treated plants
1. D.D.T. in Diatomite (1 per cent)	63
2. (a) Derris Extract, 1 part water 600 pts.	148
(b) Derris Extract, 1 part water 1000 pts.	232
3. Benzene Hexachloride in diatomite (0.5 per cent gamma isomer)	783
4. Control untreated	923

Sodium fluosilicate was tried in other experiments and proved more effective than derris extract, so pending further trials of D.D.T. it is recommended as the best field control measure, despite slight scorching of leaves. Derris Extract treatment at 1 to 600 is fairly good and may also be recommended.

Bionomics

Available knowledge of the life history of this insect under local conditions was scanty, but this knowledge is required for the intelligent application of both legislative and direct control measures. An entomologist was not available for full time observations, but means were suggested whereby valuable data on the bionomics of the insect could be obtained by an African field assistant. Through the helpful co-operation of the Senior Agricultural Officer, Kitale, who supervised his work, and also the observations for a short period of the Junior Laboratory Assistant, a considerable body of data on this subject was accumulated. There are still some gaps in our knowledge to be filled in and the work will have to be repeated in other years and conditions in order to complete a general picture of the life history in this country.

Maize was planted early in April; egg-laying occurred during May, and at the end of May there was an infestation of first and a few second instar larvæ.

averaging over seven larvæ per plant. The first pupation occurred early in July and the first adult emergence near the end of that month. The first larvæ of the second generation appeared at the end of August and these had not yet pupated by the end of October. Harvesting occurred early in November, but on other late planted maize second generation larvæ pupated at the end of November. The third generation was not permitted to develop, but adults would have been present in December and January. Further information is available which bears on the important subject of "carry-over". Dry stalks after two months' stooking in the field still contained an appreciable number of larvæ (averaging one in four stalks), with few only in the stumps after harvesting and few also in the cobs. This indicates that even dry maize can provide the carry-over from one crop to the next, although there is not a long period hibernation as occurs in South Africa. The late planted maize mentioned above became very heavily infested, averaging more than 40 larvæ to a plant, and this shows the value of the restricted planting dates since a little green maize out of season would clearly result in a large moth population to attack the new season's main planting.

There are normally two generations in a crop of maize, the second of which may not be completed by harvest. In exceptional conditions only one generation might occur and a maximum of three generations should be possible. With green maize maintained throughout the year, it is conceivable that there might be four generations in twelve months, but this remains to be proved.

Further observations on the life history are necessary to clear up some doubtful points, and in order to allow confident prediction of the stalk borer cycle in specified maize conditions.

Disposal of Maize Residues

If there is general compliance with the law in respect of planting dates, the carry-over of moths will not be great, but some carry-over will occur from larvæ and pupæ remaining alive in the dry stems and to a lesser extent in the cobs and stumps.

The stalks should therefore either be composted or, when maize is harvested standing and the stalks are to be ploughed in, they should be well disc-harrowed or grazed heavily with oxen in order to destroy pupæ in the stalks. In view of the carry-over from the cobs after shelling, all cobs should be burned, but stalks should not be burned except in the case of a heavy infestation.

It is reasonable to believe that satisfactory control of this insect will be achieved if all farmers and their squatters strictly observe the restricted planting dates, deal with the residue as advised, and regularly practise also the top dressing of the plants with one of the effective chemicals now available for this purpose.

Eucalyptus Beetle

The control of the introduced curculionid pest of gums, *Gonipterus scutellatus*, by the introduction and spread of the Mymarid egg parasite, *Anaphoidea nitens*, was mentioned in last year's report. The work of this department was fully described in an article on the beetle by Mr. D. K. Kevan, published in the *East African Agricultural Journal*, Vol. XII, No. 1, July, 1946. All work on this insect has now by agreement been taken over by the Forest Department.

Prickly Pear

For some years a certain amount of anxiety has been felt by some people that the prickly pear might become an important weed pest. In the past few dry years there have been some signs of an increase, and an investigation of the position was carried out with the Senior Agricultural Officer, Rumuruti, in the Naivasha and Rumuruti areas in May.

The common species in these areas are *Opuntia ficus-indica* and *Opuntia megacantha* with a few other less common species, mostly escapes from gardens.

In the Naivasha area the general impression was that the plant was not really flourishing—it appeared to be encountering considerable resistance in the environment, though what might constitute this resistance could not be guessed.

In the Rumuruti area also the plant seems to be meeting considerable resistance in the environment. In view of the fact that prickly pear has been present in the area visited for at least 13 years, and possibly very much more, the negligible proportion of land occupied shows that this is the case. It occupies only rocky bushland in this area and has not encroached appreciably, if at all, on good grazing land.

Chemical Control

Experiments were undertaken to determine if any available chemicals were capable of destroying the plant. Sodium arsenite, diesel oil, power kerosene, Di-nitro-ortho-cresol were used. The only promising substance was Di-nitro-ortho-cresol in diesel oil, which completely killed the above ground portions of the plants in one application. Further trials with this spray are planned and if the first results are confirmed, this may prove a useful control measure.

Biological Control.

The possibility of applying biological control by the introduction of insect pests of the plant has been considered and the advice of the Division of Entomology of the Department of Agriculture and Forestry, South Africa, was sought. They advised, from experience in South Africa, that *Cactoblastis cactorum* will not control successfully either *Opuntia ficus-indica* or *Opuntia megacantha*. They consider that, based on South African experience, the cochineal *Dactylopius opuntiae* is likely to be more effective than *Cactoblastis* in the destruction of these *Opuntias* in Kenya if it is introduced here, providing that the climate is hot and dry in the pear areas. However, even under optimum conditions, this insect will not completely eradicate the plants unless the plants are cut off close to the ground after infestation and, to accomplish this, the labourers would have to gain access to all the plants.

In the circumstances, for reasons given above and since the climate in the prickly pear areas is not hot and dry, chemical control is considered to be the line to pursue.

Chafer Grub

Work on the Chafer Grub was continued and this took the form of a number of experiments with benzene hexachloride. Great hopes were felt that an economic control might be possible with this insecticide, following the excellent results achieved with it as a soil treatment against the wire worm in England. Two fairly large field scale strip experiments were laid down near Kitale, but neither of these was very successful owing to lack of an adequate population of chafer grubs, and to general poor growth of the crop, due to unfavourable soil and weather conditions. It is clear that valuable experimental results from field trials cannot be counted on; they may result, but only when conditions are very favourable.

The technique of small-plot trials where definite populations of grubs are planted with or soon after the seed was also used, and the results of one such experiment showed no appreciable effect from dressings at the rate of 4 to 8 lb. of crude benzene hexachloride to the acre. At 16 lb. crude benzene hexachloride approximately 2 lb. gammexane per acre an appreciable beneficial effect was obtained. This rate of 16 lb. is about four times the rate used with success against wire worm in England.

A second similar experiment repeated this result by showing a beneficial effect on the growth of the flax, indicating some effect on the chafer grub at the rate of 16 lb. crude benzene hexachloride to the acre.

While these preliminary results are not very encouraging, it is planned to put down some field experiments to determine whether the first stage grubs are more

susceptible than the third stage grubs used in the plot experiments. At the moment it does not seem likely that an economic control measure will be possible with this substance, but further work is required before a definite statement is possible.

New Insecticides

Some preliminary exploratory work with D.D.T. and benzene hexachloride, in addition to that already described under other headings, was carried out during the year, in the course of which these insecticides were tried against a number of different insects. It must be stressed, however, that with the staff position as it has been, detailed work on any one subject has not been possible, and the indications given must be considered tentative only, and will have to be followed up before firm recommendations are possible.

Gammexane has been tried in stores against grain weevil and other storage pests in the form of a smoke produced from special smoke generators supplied by I.C.I., the usual rate being one 2 oz. generator to 1,000 cub. ft. of space, and the effectiveness in such cases seems to depend on the degree of ventilation present. In well ventilated stores a sufficiently high skill is not obtained, but, in closed stores it may prove effective when used in this way.

Smoke generators have been tried against termites, the smoke being generated in the main pipe leading into the nest. After a period of quiescence, it was found that nests often resumed activity. It is the old problem, also met with the sulphur-arsenic pump, of the difficulty of getting the gas into all the galleries of the nest. Further work will have to be done against termites.

Gammexane dust has been tried against harvester ants with the co-operation of the Assistant Agricultural Officer, Gilgil, but as applied against the nests it was unsuccessful. Against ants removing seed from tobacco nurseries in the Sagana area it was claimed to be effective.

It has been tried against certain household insects, and is useful against the common domestic cockroaches. The outstanding feature of D.D.T. and Gammexane is their stability and hence their persistence, and this feature which is of advantage in killing pests is a disadvantage in that it will also result in the death of beneficial insects. The possible dangers of killing parasites, predators and pollinators must be borne in mind.

Termite Resistance of Variouslly Treated Building Boards.

A test of the termite resistance of different treatments of local building board was undertaken for the East African Industrial Management Board. Preliminary results were obtained, but the experiment was still running at the end of the year.

Desert Locust

The greatest technical advance in locust control since bait was first used for the destruction of hoppers followed on the development of benzene hexachloride. This chemical, pioneered by Imperial Chemical Industries, has great advantages as a toxicant for locust baits over sodium arsenite. Imperial Chemical Industries have provided large quantities of Agrocide 7, which consists of 20 per cent of crude benzene hexachloride and contains approximately 2.6 per cent gammexane, the name given by them to the gamma isomer of benzene hexachloride, this gamma isomer being the constituent having outstanding toxicity.

A bait containing $2\frac{1}{2}$ per cent of Agrocide 7 is equivalent to one with $1\frac{1}{2}$ per cent sodium arsenite. The benzene hexachloride bait, however, has two outstanding advantages, it is quick acting and harmless to cattle. The first effects on locust hoppers, following ingestion of the bait, are often seen within twenty minutes, and death may follow in a few hours. This is of great value since the hoppers usually die in the baited area where the dead are readily seen. This has an excellent psychological effect on the labourers, since they can appreciate the value of their work with beneficial effect on their output, a point of great

importance in this country. The fact that it is harmless to cattle can hardly be over-emphasized in a cattle owing country such as this. Its use in place of the very poisonous sodium arsenite has become well-known and resulted in improved scouting and increasing help from the tribesmen.

The bait used during the greater part of the year consisted of four parts of coffee husk, with one part of condemned maize or wheat meal and $2\frac{1}{2}$ per cent of Agrocide 7 (containing 20 per cent benzene hexachloride). The bait materials are mixed together dry and transported in bags. They are moistened in the field just before use.

Experimental Work on Baits and Bait Materials

During the year arrangements were made to carry out experiments at the Scott Laboratories on the rearing of locusts in captivity for use in bait tests. Three insectaries were used, in which different combinations of temperature and humidity were tried, the object being to hasten the maturation of adult locusts so as to produce hoppers during the interim periods between breeding in the field in order that experiments could be carried out when the pressure of work on the locust technical staff was less. Though breeding was successfully accomplished, it must be recorded that the locusts did not take kindly in Nairobi to any conditions supplied. Some valuable work was accomplished, however, on the following subjects:—

(1) Estimation of the medium lethal dose of gammexane.

In view of the present scarcity of this poison and the desire to accomplish the greatest economy in baiting, it was desirable to determine with some exactitude the toxicity of the poison. Mr. D. K. Kevan, using apparatus previously designed and constructed at the Scott Laboratories for determining the median lethal dose of chemicals by the leaf sandwich method, carried out experiments which gave a provisional median lethal dose of 0.007 mg. of the gamma isomer (used in the form of a benzene hexachloride dust stated to contain 2.6 per cent of the gamma isomer). Less than twice this rate was lethal to 100 per cent of adult locusts. Using this figure, the volume of the bait material that would have to be eaten could be readily calculated.

(2) In view of the high attraction of flour as food for desert locust hoppers, it had for some time been used in the coffee husk bait as an attractant. The use of flour only as the base, with benzene hexachloride as the poison, had been considered. A bait for experiment made by grinding maize with benzene hexachloride was provided by the Senior Agricultural Chemist, whose interest and help is acknowledged. This was tried in the laboratory and first results were very promising; the bait was readily taken and death of the locusts followed.

At the end of the year plans were well forward for a trial of this bait material on a field scale. It was considered to show promise of providing another important technical advance in baiting methods.

Use of DNOC Dust Against Adult Locusts

Experiments were undertaken to destroy adult locusts settled in trees with a 14 per cent dust of 3-5 Di-nitro-ortho-cresol, using a small power duster. The duster was mounted on a lorry and the dust drifted through the trees on which the locusts were settled. The success of preliminary trials with very heavy populations of locusts on wattle trees during dull weather at Uplands were encouraging. The locusts remained in the trees for many hours, allowing time to cover considerable areas, and very high kills resulted. The power dusting machine used was of inadequate power for complete coverage of the trees, and arrangements have now been made to obtain more powerful machines, which will be tested if and when suitable locust swarms arrive in the highlands.

R. H. LE PELLEY,
Senior Entomologist.

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Seed Testing

Some three hundred samples were tested during the year. These consisted mainly of vegetable seeds produced under the Vegetable Seed Production Scheme, *Bromus marginatus* and Rhodes grass seed, Pyrethrum and Cereals. In all samples, except the grass seed and pyrethrum, the impurities were negligible. In general, the Continental method of analysis is followed. The pyrethrum analysis, however, presented some difficulty. It was, therefore, decided, in order that the tests should give as good an indication of the real value as possible, to include in the inert fraction certain immature seeds or unfertilized florets, of which most samples contain a high proportion. The retention of these very light but nevertheless "pure" seeds would give too low a value to the germination figure.

The laboratory has acquired during the year further apparatus from the United Kingdom and the United States, and is now equipped in this respect to implement any provisions there may be as regards seed testing in the legislation about to be introduced.

A number of botanical samples, weeds and weed seeds has been received for identification from the public, military authorities and police. Foodstuffs from the military authorities have also been examined for the presence of *Datura* and *Lolium*, as has a number of wheat samples from the mills in connexion with the *Datura* penalty.

A collection of indigenous and introduced seeds of weeds of agricultural crops is being built up for identification purposes.

Stem Rust

The seven physiologic races of wheat stem rust so far encountered in the Colony have been maintained in culture with difficulty. Weather and insect pests combined to make the present type of cage an unsuitable environment for the production of either healthy wheat plants or rust cultures. It has now again been possible to fit the cages with "Windolite" instead of muslin with a slight improvement in conditions.

Apart from the maintenance of the cultures, the rust work has, as in the past, consisted of testing the new hybrids produced by the Plant Breeding Section with each of the seven physiologic races and identifying, by means of reactions on the differential varieties, the physiologic races present in local field attacks.

Further supplies of seed of the Stakman and Levine differential wheats for the determination of the physiologic races, according to the American system of classification, have been received from Dr. Stakman.

Some preliminary trials with *Puccinia glumarum* were done at the Scott Agricultural Laboratories. Heavy infection of susceptible varieties followed using the general inoculation technique in the greenhouse. Although natural infections occur at about 8,000 feet and above, it appears that cultures could be maintained and the tests carried out at the lower altitudes of the Scott Agricultural Laboratories.

Potatoes

The multiplication and distribution of Blight Resistant Potatoes has continued. Of the potatoes bred by Dr. Black of the Scottish Society for Research in Plant Breeding, 914a (91) and 835a (3), having, since 1944, proved suitable to Kenya conditions, were put out for multiplication by farmers under agreement with the Department. The approximate yields of 914a (91) and 835a (3), grown under favourable conditions at an altitude of 8,500 feet, were 11 tons and 19 tons to the acre respectively; 235 lb. of seed of 835a (3) gave a crop of 18½ cwt.

Immunity from blight has been maintained in all districts by these two varieties and others under trial. Six new seedlings from Dr. Black were received during the year and have been grown twice at the Scott Agricultural Laboratories. These are immune from the blight strains "A" and "C", but not "B". The strain of blight present in Kenya is either A or C, or both. There is, as yet, no evidence of the presence of the B strain, or a newly evolved one. This fact is additional evidence that the blight in Kenya is an introduced and not an indigenous one. I have now in production a further seedling of Dr. Black's which is immune to A and B, but which is susceptible to C. It should, therefore, be possible to detect, with these differentials, any new form which may appear, and which of the forms is at present in the country.

The blight immune hybrids received from Professor Reddick from the U.S.A. have been further reduced. The tests of these for suitability to Kenya conditions are being continued. Blight resistance has been maintained in all. Among these potatoes is the blight immune "Empire", of which some thirty tubers are now available for planting in 1947. In the trials at the Scott Agricultural Laboratories, the red skinned American potatoes were, on the whole, much more susceptible to attack by eelworm, *H. marioni*, than were the white skinned varieties.

Of the blight resistant potatoes bred by Dr. Salaman and Mr. Clarke of Ballycastle, Salaman Clarke 2 and the variety, Dutch Robyjin, have been issued to farmers.

During 1946 the variety, Dutch Robyjin was, for the first time, attacked by blight and is consequently being discarded.

Before distribution the potatoes were grown, for the most part, at the Scott Agricultural Laboratories. There is here a considerable infiltration of virus, mostly X and Y. There is a marked difference in the health of potatoes grown once only at the Scott Agricultural Laboratories and of those grown there a number of times. Further stocks of the most suitable kinds are being obtained. These will be sent direct to the higher altitudes, where it will be possible to maintain the health of the stocks for much longer periods.

The total quantity of seed issued to farmers during the year was:—

No. 914a (91)	.. = 700 lb.
No. 835a (3) ..	.. = 235 "
Salaman Clarke 2	.. = 200 "
Dutch Robyjin	.. = 230 "

The arrangements for the supply and distribution of the crop have been made by the Senior Agricultural Officer, Rumuruti.

A number of local potato varieties is being studied by the Imperial Bureau of Plant Breeding and Genetics and has been passed to the Potato Synonym Committee at Sutton Bonnington. One collection, No. 41, is reported to be possibly immune from virus Y.

Forestry Diseases

During the year I have, as in the past, acted as pathologist for the Forest Department in so far as my other duties have permitted.

The canker disease of *Cupressus* species has been further studied. A comprehensive investigation of cultural characters and temperature and pH relationships were completed by Dr. A. Ciccarone in the laboratory before his repatriation. Dr. Ciccarone also carried out a further series of experiments on infection.

It is now established that *C. lusitanica* and *C. arizonica* are as susceptible (by inoculation) as *C. macrocarpa*.

Although widespread from the eastern escarpment of the Rift Valley eastwards, no incidence of the disease has been reported west of the Rift Valley.

A leaf cast of *Pinus insignis* from Elburgon was caused by *Nemacyclus niveus* (Pers. ex Fries) Sacc. This is believed to be the first record of this genus in Kenya. It is possibly an introduction from America, where *N. niveus* also occurs on *Pinus insignis*.

A plantation of young *Eucalyptus globulus* trees at an altitude of 8,000 feet was affected by a stem canker disease. The trees, which were between three and four feet high, were frequently girdled by the canker and broken off. The cankers appeared to originate from an infected leaf, of which all stages were found from a lesion on a leaf with a healthy petiole to a diseased leaf with a small lesion starting on the stem where joined by the leaf petiole. In one or two rare instances, conidiophores and conidia of *Botrytis* sp. were found on the diseased material. Isolations made from tissue of the stem cankers and leaf lesions produced cultures of the *Botrytis* with conidia and sclerotia, the latter being up to 5 mm. in diameter. Sclerotia also developed on diseased material kept in a moist atmosphere.

Further study of this apparently new disease of *Eucalyptus* has not been possible, nor has the species of *Botrytis* been determined.

Non-emergence of a number of parasites (*Anaphoidea nitens*) of the eucalyptus snout beetle in one area is attributed to an entomogenous fungus. The fungus, which has not been identified, attacked the parasite just before it reached maturity. No fructifications were seen, but the mycelial characters in the diseased insects suggested an *Empusa* type of fungus. It was not possible to continue the investigation.

A quantity of material from the forest areas was examined and reported on for root and bole rots. In some instances, the death of trees in certain areas was attributed to the effects of drought some time previously.

Pyrethrum

A new disease of pyrethrum caused by *Ramularia bellunensis* Speg. made its appearance during the month of June. Growers were alarmed at the sudden falling off in yield, which was particularly severe in the Molo district from where the disease was first recorded.

The disease affects mainly the buds, which fail to open, but all stages from unopened buds to mature flowers are attacked. When attacked, the buds either fail to open or become aborted. Usually the fungus can be seen as a more or less indistinct white mould on the involucre scales and on the apical inch or so of flower stalk. The diseased parts are discoloured a light brown in contrast to the blackening which usually results from after effects of frost or other fungi such as *Alternaria*, etc.

The white mould is not always visible externally, but can invariably be seen with a lens as conspicuous tufts on the inner surface of the involucre bracts. This is diagnostic of the disease.

The disease also attacks, but apparently less frequently, the foliage but without causing definite leaf spots. The leaves generally become brown and covered with the fungus from the tip downwards.

The fungus also occurs on the seed, but on neither the fused pappus nor the petals; it is typically a disease of the buds and flowers.

The Kenya material has been reported on by the Imperial Mycological Institute as being indistinguishable from the type collection of *R. bellunensis* Speg. in the Herbarium, Kew. It has not, presumably, been recorded previously on pyrethrum.

The outbreak was most severe in the important Molo pyrethrum area and caused considerable loss running into some thousands of pounds in value. From August onwards, reports of the disease came in from most areas, both east and west of the Rift, although decreasing in intensity towards the end of the year when it was still present, attacking newly formed buds and flowers in most areas of the Colony.

Trials on control measures have been done by the Pyrethrum Research Officer. Spraying with copper sprays has been ineffective. Other measures under trial are cutting back and burning trash.

The fungus has not been seen on any other host. It is possibly a recent introduction. The fungus is readily carried in seed samples, especially on fragments of the involucre bracts. The well developed stroma on which the conidio-phores are borne no doubt serve to perpetuate the fungus. The spores themselves appear to be comparatively short lived.

Other diseases of root and crown referred to in previous reports have been seen from time to time.

A collection of *Kordyana*, which almost destroyed a pure stand of *Commelina* (nudiflora?) several yards in extent was determined by the Imperial Mycological Institute as *K. celebensis* Gaum.

A leaf disease of *Anona reticulata* in the Limuru district was caused by an unidentified fungus. Practically every leaf was attacked, causing considerable defoliation. The lesions were black, involving large areas of the leaf, and extending frequently down the mid rib to the petiole. A characteristic of the fungus is large radiating mycelial strands on the upper surface of the leaf, extending to within a short distance of the margin of the lesions. The colour of this mycelium is dark, but with a white fringe along the margin. Pycnidia occur immersed in the leaf tissue, scattered irregularly and opening on to the upper surface of the leaf.

The pycnospores are hyaline, 1-septate, straight or slightly curved, resembling in general appearance those of the genus *Ascochyta*. They measure $10-12 \times 2-3$ microns. According to a report from the Imperial Mycological Institute it does not resemble anything on this host at Kew. The fungus, when grown in culture, produces a dark mycelium and pycnidia. Inoculations of leaves from these cultures showed active parasitism.

An instance of "Flat Limb" occurred among "Gravenstein" apples in a Kinangop orchard.

R. M. NATTRASS,
Senior Plant Pathologist.

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Staff

Mr. R. J. Lathbury, Senior Plant Breeder, left Kenya in July on leave pending retirement.

Mr. H. C. Thorpe, Plant Breeder, continued with his duties as Agricultural Officer, Nakuru District, until March, when he proceeded on overseas leave to the United Kingdom. On his return in July he returned to plant breeding work of which he took charge.

Wheat—General

The rains were again very late in starting and anxiety was felt regarding crop yields. However, once they set in good rains were experienced continuing later than usual and turning what at one time was feared would be a poor season into a favourable one. Good yields generally were harvested over most of the wheat growing areas of the Colony.

Rust and Other Diseases

Little stem rust was in evidence during the season and damage to crops has been slight. Physiologic form K6 seems to have been the prevalent form.

Main Varieties Grown

No. 117.A and Sabanero were once again the main varieties grown. No. 117.A suffered, as in the past, from lack of straw strength and although, in many cases, excellent crops of this wheat were harvested, there is an increasing tendency for the variety to be replaced by newer, stronger-strawed hybrids, especially 291.J.1.1.1.

Equator is still the mainstay of the high altitude wheat areas on account of its resistance to yellow rust.

Other wheats which, although not rust resistant, are grown in areas suited to them are Kenya Governor, Burbank, Reward and N.B.230.

Pedigree Seed

Stocks of pure 117.A and Rhodesian Sabanero were further increased by farmers and will be tried out on an extended field scale in 1947.

Wheat Releases

Two wheats were released for general cultivation in the Colony, Regent R.L.975.6 and Equator II. Over 2,000 bags of each were produced for seed purposes by farmers.

Regent R.L.975.6 is a hard red beardless spring wheat imported from Canada. It is of medium maturity in Kenya, being a shade slower than 117.A. It has good straw and stands well. It has again proved resistant on a field scale to orange leaf rust, and it is also resistant to yellow ear rust up to 8,000–8,500 ft. in Kenya. Seedling inoculations show Regent to be susceptible to two, K6 and K7, of the seven physiologic forms of black stem rust known in Kenya at the present time. The wheat has, however, not rusted in the field, although some rust has been found on it in the breeding cages at the Scott Agricultural Laboratories, Kabete. The grain is of filler-class quality and is acceptable to the mills.

Regent has been under trial on a large scale for three seasons in the Plateau and on Mount Elgon, where it has yielded well and kept free of disease. Growers are warned in the notice announcing its release that the wheat is not fully rust resistant and are, accordingly, advised to proceed slowly and not to sow large acreages nor an excessively high proportion of their total wheat crop to it.

Equator II is a single plant selection out of ordinary Equator, a mixed crop composed of various types. The selection is a lax, beardless variety of which it is considered Equator originally consisted. Strength of straw, resistance to stem and yellow rust, time to maturity and milling and baking quality are all about equal to the ordinary unselected crop.

Equator II has done well in large scale trials over the past three seasons in the Molo/Mau area of Kenya, where it has out-yielded the ordinary crop. It is suited to all areas where Equator is ordinarily grown.

Wheat Breeding at the Plant Breeding Station, Njoro

The following crosses are under trial and multiplication: 291, 261, 294, 318 and 321.

Cross No. 291 (Australian 26.A x 58.F (L.1.))—The one strain released in 1945, No. 291.J.1.1.1, was grown extensively in the medium altitude wheat areas, where it has continued to prove successful due to its strong straw and good yielding capabilities. It remained free from stem rust—although minute pustules were seen on a late planted crop in the Mount Elgon area—and it was not attacked by leaf rust, to which it is susceptible. The grain is not favoured by the mill's on account of its poorish baking qualities. 291.J.1.1.1 is not suited to areas over 7,000 ft. in Kenya on account of its susceptibility to yellow rust.

Single plant selections for better bushel weight were made in the parent strain in 1945 and have been multiplied up for test. One bearded selection topped the yield trial this year.

A bulk sample of selections of highest bushel weight has now reached the bag stage.

Cross No. 261 (68.E.12.A.1 x Reliance).—The one strain issued to growers, No. 261.R.7.C.1.B, and described in the Annual Report for 1945, was again grown under trial in the Ulu area. The season was not a fair one, due to drought and locusts, and yields were low, but the 261 variety compared favourably with other wheats grown under the same conditions.

In the Mount Elgon area 261.R.7.C.1.B kept free of stem rust, but suffered fair leaf rust attack.

Cross No. 294 (Australian 26.A x 117.A).—Four strains issued to growers in 1945 were again under test and multiplication. Over 200 bags of No. 294.M.7.C.6.A were harvested, yields of ten bags per acre being obtained on Mount Elgon and eight bags per acre at Londiani, Njoro and Ol'Joro Orok. The wheat remained free of rust.

Twenty-one bags of No. 294.M.7.C.6.C, a very similar wheat, harvested by a grower, will be carried on. It is of interest to record that this wheat proved very successful in small scale trials in Northern Rhodesia.

No. 294.B.2.A.3, an earlier maturing strain, was again grown at Kilima Kiu where it matures about ten days later than Kenya Governor. During the long rains in this area, on black cotton soil, a yield of four bags per acre was obtained over twenty acres, although no rain fell after sowing, whilst with some showers after sowing the yield increased to seven bags an acre over six acres. The variety was also under trial in the Solai, Njoro, Plateau and Ol'Joro Orok areas of Kenya and in the Arusha district of Tanganyika.

The remaining selection, No. 294.H.2.A.1, of which one bag was issued to a grower in 1945, will be again increased under test in 1947.

These four strains are all of promise and will be continued with for a further season so that a decision may be arrived at regarding their future. They are of moderate but useful baking quality.

Two further strains, No. 294.M.7.C.1.C and No. 294.AN.5.B.3, yielded 10½ and 9½ bags per acre respectively in the yield trial at Njoro and will be multiplied for further test.

Further details of this cross will be found in the 1945 Report.

Cross No. 184 (Reliance x 73.D.2.I.1).—This cross, although of high yield and excellent baking quality, has had to be discarded on account of weak straw. It has, however, been used in crosses with stronger strawed wheats in an attempt to improve its straw quality.

Cross No. 318 (Rust Resistant Selection out of D.C. x Ceres 721 x 112.E.8.L.5).—The two strains under trial and multiplication, No. 318.AJ.4.A.1 and No. 318.O.3.B.2, have not yielded as well this season as they did in 1945. In the yield trial at Njoro both gave about 6½ bags per acre, and No. 318.O.3.B.2 yielded 5½ bags per acre on a field scale at Ol'Joro Orok. In view of their earlier good yields, both strains will be carried on under test in 1947.

Yields of Some Newer Hybrids

The following figures showing the yields of new hybrids are of interest. The Njoro figures refer to yields obtained in the yield trials over a three-year period; at Ol'Joro Orok the 1945 figures were taken from the yield trial and the 1946 figures are from tests carried out on a field scale.

Yields of some Newer Hybrids at Njoro and at Ol'Joro Orok

Variety	Njoro 7,100 ft.	Njoro 7,100 ft.	Njoro 7,100 ft.	OJK. 7,800 ft.	OJK. 7,800 ft.
	1944	1945	1946	1945	1946
291.J.1.I.1	9.7	10.3	9.5	—	—
294.M.7.C.6.A. ..	11.0	10.0	8.6	—	8.0
294.M.7.C.6.C. ..	11.0	11.2	9.2	12.7	—
294.B.2.A.3	9.7	10.2	9.3	10.9	9.0
294.H.2.A.1	9.9	10.9	9.2*	—	—
294.AN.5.B.3	8.3	9.2	9.5	11.8	—
294.M.7.C.1.C. ..	—	—	10.4	—	—
261.R.7.C.1.B. ..	10.6	10.0	8.8	—	—
261.S.10.C.2.D. ..	7.4	—	8.9	—	—
318.O.3.B.2	—	8.9	6.4	13.2	5.5
318.AJ.4.A.1	—	10.6	6.4	—	—
184.P.2.A.1.F. ..	—	11.5	9.2	—	—
Regent 975.6	8.5	9.1	7.8	13.3	11.5
117.A.	9.4	9.2	6.7	10.4	8.0
Sabanero	8.2	6.4	6.6	8.1	—

* A selection out of 294.H.2.A.1.

It will be seen that the new strains have mostly out-yielded established varieties such as 117.A and Sabanero.

New Hybrids Undergoing Multiplication at the Plant Breeding Station, Njoro

Selected strains from crosses 337, 344, 350, 340, 341, 342 and 351 were increased during the year. Trials were also carried out at the high altitude station at Molo, 9,300 ft., and at the Scott Agricultural Laboratories, Kabete, to test possible differences in rust reactions and straw strengths.

Cross No. 337 (223.F.1.A.3 x 291.J.1.B.1).—The 15 strains selected for increase in 1945 remained free of stem rust but showed differences in their susceptibility to yellow rust and in their straw characters. Some of them are likely to be suitable for the higher wheat areas. The grain is attractive.

Cross No. 344 (279.I.5.F.2 x 291.J.1.B.1).—As in the past season, this cross has not shown complete stem rust resistance and variable, slight or moderate infection was seen on all the cultures. The stem and ear coloration, remarked on in 1945, was again in evidence, especially at Molo, and gave the cultures an unattractive appearance. The straw is, on the whole, good and the grain attractive.

Cross No. 350 (223.F.1.A.3 x 294.M.7.C.8).—Thirteen strains, carried on from last year, remained free of stem rust in 1946, although in past seasons a certain amount of stem rust was shown by some. There are differences between cultures in leaf and yellow rust reaction. The straw is generally good and the grain bold.

A few strains out of the crosses No. 340 (UX.9.M.1.A.9.D.2 x Regent 975.6), No. 341 (279.I.5.F.2 x Eureka G.2503), No. 342 (279.I.5.F.2 x 210.E.1.C.1) and No. 351 (117.A x Regent 975.6) have been grown on for increase, but, as in 1945, they are not so promising as the three crosses first discussed.

Cage Material

Material in the early stages of breeding included the following crosses:—

Cross No. 357 (184.P.2.A.1.E x 294.AN.4.A.1) and Cross No. 359 (184.P.2.A.1.E x 291.J.1.I.1).—These crosses, now in F.3, aim to combine the high yield and quality of the 184 parent with the strength of straw of the second parent. Some promising cultures have shown up and strong strawed plants of the desired type were harvested.

Cross No. 353 (Warigo x 291.J.1.I.1).—In this cross it is hoped to combine the yield and straw strength of No. 291.J.1.I.1 with the leaf rust resistance and baking quality of Warigo. This cross is also in F.3.

Other crosses being grown are:—

- No. 352—Wariga x 117.A.
- No. 354—Warigo x Sterling.
- No. 355—117A. x 291.J.1.I.1.
- No. 356—184.P.2.A.1.E x 192.Q.2.A.(L).
- No. 358—184.P.2.A.1.E x 294.B.2.A.3.
- No. 361—294.M.7.C.6.C x 117.A.
- No. 362—Equator x 294.M.7.C.6.C.
- No. 363—Warigo x 261.S.10.C.2.D.
- No. 364—Warigo x 261.S.10.C.1.A.
- No. 365—Warigo x 261.R.7.C.1.B.
- No. 366—Warigo x 294.B.2.A.3.
- No. 367—Warigo x 184.P.2.A.1.F.

The first five crosses are in F.3, the remainder in F.2.

Importation

The American hard red spring wheat Newthatch C.I.12318, tried out for the first time in 1945, was further multiplied. It again proved resistant to stem and leaf rust at Njoro but had some stem and leaf rust infection at the Scott Agricultural Laboratories. It proved susceptible to yellow rust at Molo. The straw is good but the ears seem rather small. Further tests will be carried out in 1947.

Two American durum wheats, Carleton C.I.12064 and Stewart C.I.12066, found susceptible to stem rust in 1945, were again badly attacked at Njoro. Both have very tall straws and although Carleton stood well Stewart lodged.

The Australian variety Warigo was again free of stem rust at Njoro and Kabete, but showed some rather unhealthy die-off of the lower leaves. This wheat

has rusted in past seasons and seedling inoculations show it to be susceptible to three, K1, K4 and K6, out of the seven physiologic forms.

Warigo has been used in crosses on account of its resistance to leaf rust.

Wheat Breeding at the Scott Agricultural Laboratories and at Molo Sub-station

Eight strains of Cross No. 338 (192.Q.2.A.(L) x Australian 27/2.2.1.5) were multiplied during the long rains. All the cultures were attacked by stem rust, most to a slight degree, although two of them appeared more susceptible.

Cross No. 339 (192.Q.2.A.(L) x Australian 37.2.5.4) has now reached F.5 but does not yet appear fixed as differences in maturity within the strains were observed. All the selections were attacked to a greater or lesser extent by stem rust.

Cross No. 356 (184.P.2.A.1.F x 192.Q.2.A. (L)) and Cross No. 358 (184.P.2.A.1.E x 294.B.2.A.3) have already been noted, the aim being to try and combine the good yield and baking quality of No. 184 with the straw strength of the second parent.

These crosses are early maturing and are bred for areas similar to Nairobi with a short season.

All pure line material and material from the more advanced crosses were sown at both the low and the high altitude stations, which serve as additional testing areas for stem rust and, in the case of Molo, for yellow rust also.

Pelschenke Wholemeal Fermentation Tests

These tests, which serve as a general guide to baking quality, were carried out on all new hybrid material.

Barley

The barley variety trial at Njoro included the new varieties first tried out in 1945, Kenia, a two-row from Denmark; Glacier C.I.6976, a six-row from America; the Canadian six-row Mariout; Research, a two-row from Australia, and an unnamed broad-eared two-row German barley.

Glacier was developed co-operatively by the Montana Agricultural Experiment Station and the United States Department of Agriculture and was released for production in 1943. It has yielded well in Montana State but, on test, ranked low in quality producing a malt with low diastatic power. At Njoro, in 1946, it came top of the yield trial. A test on the 1945 crop showed it to have a low nitrogen content and it has yet to be seen if Glacier can produce a malting sample in Kenya. However, be that as it may, its good straw, resistance to leaf blotch and plump grain make it of distinct promise as a feed barley. It will be issued to growers for multiplication in 1947.

Mariout, whilst showing some susceptibility to leaf blotch, nevertheless yielded well and showed a semi-mealy cut. It stood well and will be carried on to test its performance over a further season.

Research has good straw but was badly attacked by leaf blotch. The ears are broad and attractive, the grain plump with a fairly mealy cut.

German barley, although tall, has good straw and showed little leaf blotch. The grain, however, was very steely.

Kenia seemed weaker in the straw but stood fairly well. It suffered a fair attack of leaf blotch. The ears are rather small and narrow and its performance in the trial—it came bottom—not very encouraging. It has rather small grain with a steely cut.

The standard variety, Prior, suffered as usual from weak straw and lodged. It was fairly badly attacked by leaf blotch.

Yields obtained in the 1946 trial together with figures for nitrogen content and 1,000 corn weight, are:—

VARIETY	YIELD (Bags of 180 lb.	NITROGEN CONTENT	WEIGHT OF 1,000 CORNS	
	1946	1945	1945	1946
		<i>Per cent.</i>	<i>Gms.</i>	<i>Gms.</i>
Glacier	16.2	1.63	56.5	49.1
Mariout	14.5	2.05	42.3	46.1
Research	14.1	—	—	45.5
Prior	12.0	2.03	55.5	46.1
German	11.8	2.24	48.2	50.5
Kenia	11.2	2.10	44.6	36.0
Maltworthy * ..	—	1.85	46.2	—

At Ol'Joro Orok, Research yielded 16½ bags per acre on a field scale.

Oats

The standard variety, Lampton, suffered slightly from rust at Njoro but remained free at Molo.

Cedar C.I.3314, an early yellow awnless oat from America imported for trial in 1945, was badly attacked at Njoro and quite severely at Molo.

White Tartarian and Grey Algerian were only slightly attacked at both station, but suffered from weak straw and lodged.

Achilles, an awned variety from New Zealand, remained free of rust but lodged badly on account of weak straw. It yielded 11 bags per acre on a field scale at Ol'Joro Orok. It is being increased at Molo for large scale trials.

Six new oats from Canada were grown for the first time. All had very good straw and stood well. Four were badly attacked by stem rust, but two showed some resistance and will be carried on. As these varieties are all awnless, they should be suitable for milling if a plump sample can be grown.

Pyrethrum

Pyrethrum breeding, which was virtually at a standstill during the war years due to staff shortages, was again intensified. About one thousand single plant selections were made, both in ordinary bulk crop and in the High Toxic I strain. Selection in the field was based on uprightness of growth, large flowers borne on sturdy stalks and a prolific habit. Selected plants were then split up and planted on the pyrethrum stations at Molo and Ol'Joro Orok for further study. Of the selections so far analysed, those possessing the highest toxicity coupled with a desirable habit of growth have been planted out in isolated plots for seed production.

High Toxic I, synthesized by crossing two high toxic clones, No. 14 and No. 24, was first issued in 1942 and there are now appreciable acreages planted to it. It is, therefore, possible to give some account of its performance in the field. Tests carried out by the Agricultural Officer (Pyrethrum) at Molo and Ol'Joro Orok have shown that at both these stations there is, up to date, no difference either in yield or in ease of establishment of seedlings or splits between High Toxic I and ordinary unselected crop. On the other hand, it is established that the pyrethrins content of High Toxic I is higher than that of unselected

pyrethrum, the flowers are larger and the habit more upright, making for greater ease of picking and consequently less wastage. Figures collected from various pyrethrum areas—Elgon, Kipkabus, Mau Summit, Molo, Njoro and Dundori—show the following interesting position:—

	PYRETHRIN I	PYRETHRIN II	TOTAL	FLOWER HEAD Wt. in Mgs.
High Toxic I ..	·997	·631	1·628	193
Unselected	·779	·591	1·370	150
Difference .. .	·218	·040	·258	43
Per cent Increase over Unselected	28	6·8	19	29

It will be seen that the higher total pyrethrins content of flowers of the High Toxic I is chiefly due to an increase in pyrethrin I. If pyrethrin I is more toxic than pyrethrin II—as is generally considered—this may prove to be an additional point in favour of the high toxic strain.

High Toxic I has not proved universally suitable and has not yielded so well in the lower, warmer pyrethrum areas. This is scarcely surprising since the strain was developed for the higher areas and it would be, perhaps, unusual to find in pyrethrin, as in other crops, a variety which would be suited to all conditions. But it does emphasize the need for intensified breeding work to produce strains to cover the range of altitudes and climates met with in the pyrethrum growing areas of the Colony.

As it is expected that growers will shortly be paid on the toxic content of their flowers, shown by analysis, instead of on the present method of visual grading, it became necessary quickly to produce high toxic seed in bulk for issue so that the change to higher test pyrethrum might be made as speedily as possible. One method of accomplishing this would have been to produce a second issue of High Toxic I by increase of the parent lines and their isolation for seed production—a matter of some years. Time would not, however, permit of this being done, so an alternative method was undertaken. In conjunction with the Pyrethrum Board of Kenya and by arrangement with the owners, certain plantations of High Toxic I were shut up for seed production. As a result, a very substantial quantity of seed was produced in 1946 and has been sold to growers by the Board. New plantations will thus speedily be established and will come into bearing in 1947 when payment on pyrethrins content is expected to begin.

This second seed issue should, it is hoped, enable the toxic content of Kenya pyrethrum to be raised to take advantage of the new system of payment and will fill the gap until proven strains of higher toxicity can be developed.

Acknowledgments

My thanks are due to Dr. R. M. Nattrass, Senior Plant Pathologist, for testing and identification of physiologic rust forms and for the production of material for artificial rust epidemics in the breeding cages; to Mr. W. H. Hewitt, Assistant Agricultural Officer, for help with the sowing and harvesting of wheats at the Scott Agricultural Laboratories; and to the officers of the Pyrethrum Stations, Mr. E. W. Gaddum and Dr. U. Kroll, for help in planting and recording the pyrethrum breeding material.

H. C. THORPE.
Senior Plant Breeder.

ANNUAL REPORT OF THE SENIOR AGRICULTURAL OFFICER, PASTURE RESEARCH, 1946

Staff

European.—Mr. D. C. Edwards was in charge of Pasture Research until November, when he went on leave and was relieved by Mr. R. O. Williams.

African.—Laboratory Assistant, 1; Neopara, 1.

General

Advisory correspondence with Departmental Officers and farmers continued as in former years. Eight questions were answered in farmers' broadcast problems, dealing with the following subjects:—

- (a) Eradication of Water-Grass (*Cyperus rotundus*).
- (b) The improvement of the tufted *Pennisetum catabasis* and *Andropogon* sp., grassland type of Sotik.
- (c) The establishment of a Rhodes Grass (*Chloris gayana*) ley.
- (d) The sowing of Brome grass (*Bromus marginatus*) under cereals.
- (e) Three questions on Kikuyu grass (*Pennisetum clandestinum*) permanent pasture.
- (f) *Bromus marginatus* versus Rhodes grass in high areas.

Subject (a), Water grass, which occurs amongst Kikuyu grass in the high rainfall and high fertility areas, is probably a question of drainage, as the water grass comes in most markedly where stock are concentrated and trampling takes place. Eradication is not an easy matter owing to underground tubers, and eventually ploughing out may be the only answer.

Subject (b) is on a localized problem and is the result of impeded drainage on low-lying "vlei" land. Soil drainage and more intensive farm management would appear to be the answer.

Subject (d), the sowing of *Bromus marginatus* with cereals, such as barley and oats, has not proved satisfactory.

Subject (f), in areas where the rainfall is above 40 inches and the elevation is above 6,500 ft., *Bromus marginatus* is the better grass.

A broadcast talk in the Self-help series for African consumption was prepared on the subject of Grassland Management.

An address was delivered to the Production Conference on the subject of Pasture Leys.

Main Lines of Work

The main lines of work were as follows:—

- (a) Survey and classification of vegetational types.
- (b) Studies on the management of certain natural grassland types and investigations regarding their deterioration.
- (c) Encouragement of ley-farming.
- (d) Plant introduction and trial. Study of promising indigenous pasture plants.

(a). Survey and Classification of Vegetational Types.

The survey and classification of vegetational types reached the stage where it was possible to collate information gained in past years and produce a vegetation map for the Horn of Africa, including Kenya. The map, together with descriptions of the vegetational types, should be available shortly. A map of this sort is considered essential as a basis for regional research.

(b) *Studies on the Management of Certain Natural Grassland Types and Investigations regarding their Deterioration.*

The major grassland problems requiring solution are as follows:—

- (i) The management of Red Oat grass (*Themeda triandra*) in drier areas where cultivation of crops is not practicable on account of low rainfall, e.g. Laikipia, Rumuruti, etc.
- (ii) The management of Red Oat grass in the high-rainfall areas above 7,000 ft. in order to prevent the intrusion of the coarse tufted wire-grass (*Pennisetum schimperi*). In addition, investigation of means of suppressing wire-grass.
- (iii) The management of Star grass (*Cynodon dactylon*), particularly in the Rift Valley and Rift Valley Province, in order to prevent the intrusion of the objectionable annual grass, *Aristida adscensionis*.
- (iv) The control of shrub encroachment.

The first essential involved in these problems is fencing, in order that the proper rotation of grazing, fire and any other weapon that appears necessary in pasture management can be used properly.

There is an experiment dealing with (i) under the supervision of the Senior Agricultural Officer, Rumuruti; dealing with (ii) at E. H. G. Augeraud's farm, near Thomson's Falls; and to deal with (iii), plans were well advanced by the end of the year for setting up plots on Soysambu Estate, near Naivasha.

The problem of bush encroachment has so far received little attention.

(i) The experiment at Rumuruti is showing that Red Oat grass can be managed without the use of fire in *that* area provided that the grass is allowed to seed fairly regularly, but final conclusions are not yet available. It is of interest to note that at Ngong a different conclusion was reached, namely that fire was necessary in order to maintain Red Oat grass.

(ii) The experiment on the suppression of *Pennisetum schimperi* in favour of *Themeda triandra* near Thomson's Falls was started in 1944 and, although it has not been going for long enough to reach a definite conclusion, it appears that a combination of burning and resting is the solution, while grazing of the new season's growth may not be disadvantageous. The following results, computed from the readings of line transects, indicate the decrease of *P. schimperi* under the treatment (A in table) of an annual burn in March with complete protection throughout the year as compared with normal farm practice of burning every two years and protection neither before nor after burning (B). Also in the following table (C) is the associated problem of eradicating *P. schimperi* in patches of higher fertility, i.e. old sheep bomas. The treatment is the same as for (A) (see above), but the result is the reverse. One can only conjecture as to whether burning has been effective or not, since, in many places, the hearts of clumps have been killed by the fire while the perimeter progressed outwards. The large increase of *P. schimperi* is not, therefore, very much due to new plants.

Per cent Increase or Decrease	Per cent of 1944 <i>P. schimperi</i> gone out in 1946	Per cent of 1946 <i>P. schimperi</i> new since 1944	Per cent of 1944 <i>P. schimperi</i> persisting in 1946
<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>	<i>Per cent</i>
A. —68	90.5	63.0	9.7
B. +71	60.0	78.2	24.25
C. +77	31.5	63.3	75.0

Farmers' interest is being aroused in trying out the following treatment: "Protection before burning, and grazing after burning, i.e. burn in March, graze when sufficient growth (probably May and June), then protect from grazing in July and until the next burn in March".

(iii) The deterioration of Star grass pastures is probably connected with water relations of the soil and plant. Unseasonal and inadequate effective rainfall has accentuated overgrazing. The projected experiment will include treatments of grazing and resting at different times of the year, complete resting, burning, manuring, haying and no grazing, ripping and permanent grazing by cattle and sheep.

(c) *Encouragement of Ley-farming.*

Temporary leys using *Bromus marginatus*, Nzoia Rhodes grass (*Chloris gayana*), and Molasses grass (*Melinis minutiflora*) are becoming more established as part of the general arable farming practice, at least in the European settled areas. *Bromus marginatus* was used on the farmlands above 6,500 ft. where rainfall was above 40 in., while the other two grasses were confined to the lower farming areas. One vital stage connected with the increased use of grass leys, namely that of seed production, has been satisfactorily passed in the case of *Bromus*, and there was, in fact, a surplus of seed, but in the cases of Rhodes grass and Molasses grass, the position is not so satisfactory, although most farmers have been able to obtain some seed to start them off and enable them to grow their own. The Molasses grass seed production was almost entirely confined to the Uasin Gishu and Trans Nzoia areas, and distribution has taken place by sales between farmers with the Senior Agricultural Officer, Kitale, acting as liaison. Rhodes grass production has been carried out at Kabete and Thika on coffee estates under the supervision of the Senior Agricultural Officer (Pasture Research) in order to maintain the pure Nzoia strain, and this seed has gone to farmers in the main European farming areas. Farmers in the European areas also collected their own seed of Rhodes grass, and in December it was decided that the main production might be better carried out in the main farming areas where farmers had their own harvesting machinery. The pure Nzoia strain would be maintained at Kabete. Grass seed production is hampered in some ways by the fact that it pays better to grow wheat than grass seed.

(d) *Plant Introduction and Trial.*

The introduction of grasses and other forage plants continued and at Kabete there are numerous species planted and observed regularly. It is from the observation plots that likely species are chosen. With the expansion of pasture research services and the establishment of stations in various vegetation zones, the search for likely grasses and legumes should become even more effective.

ERRATA—PASTURE RESEARCH REPORT, 1945

This opportunity is taken of correcting errors in the 1945 Report as follows:—

- p. 101. Last line of 1st paragraph under heading "Observations on the Effect of Soil Structure": for "(three years)" read "(five years)".
- p. 104. Table II, 4th line in date column: for "23-8-44" read "28-8-44".
- p. 106. 9th line of 2nd paragraph: after "*Eragrostis curvula*" insert "a".
- p. 107. 7th line of first paragraph: for "R2342" read "R2S42".

R. O. WILLIAMS,
for Senior Agricultural Officer (Pasture Research).

ANNUAL REPORT OF THE AGRICULTURAL OFFICER (PYRETHRUM SERVICES) 1946

Staff

Mr. E. W. Gaddum, Agricultural Officer, went on leave in March, returning in August. During his absence the work was carried on by Dr. U. Kroll, Pyrethrum Assistant, who was engaged on pyrethrum experimental work throughout the year.

Experimental Stations

The planting programme, started in 1944, was completed this year. Five experimental stations, at Molo Ol'Joro Orok, Kinangop, Subukia and Kitale, have been opened and planted up.

Molo.—No development work was carried out at this station and facilities remain very primitive. It is now proposed that the Pyrethrum Assistant should be posted permanently at Molo and that this station should also be the headquarters for work on fruit. It is hoped that it will be possible to erect some permanent buildings in 1947 and to proceed with development work generally.

An experimental orchard of $2\frac{3}{4}$ acres was planted with deciduous fruits by the Fruit Officer.

Ol'Joro Orok.—This station is situated on the new Government farm. It is proposed that the Agricultural Officer (Pyrethrum) should be posted here and work was started on the buildings this year. By the end of the year fair progress had been made with the construction of offices, labour lines and the Agricultural Officer's house. A start had been made with the installation of the water supply.

A building for an Ngata drier was built by the Pyrethrum Board close to the experimental plots and the drier installed.

Experimental work consisted mainly in carrying on the trials planted in 1945. New plantings included a rotation experiment and a trial of two high toxic strains.

Kinangop.—Most of the trials planted in the short rains, 1945, failed owing to dry weather and had to be replanted in 1946. The pyrethrum is now growing well and experimental results are beginning to be obtained. Work on the labour lines was completed.

Subukia.—This station was planted up this year. The pyrethrum has made good growth and experimental results are beginning to come in. Progress in the fencing of this plot and the building of labour lines has been slow, but it is hoped to complete development work in 1947.

Kitale.—This station is situated on the new Government farm. It was opened this year and planting took place in June. It is not proposed to extend this station to the same degree as other stations as it is representative of only a comparatively small pyrethrum growing area. From the experimental point of view, however, it is interesting as it affords an opportunity of studying pyrethrum growing at a low altitude.

Experimental Work

By the end of the year the following field trials had been established since the commencement of the planting programme in 1944:—

Ol'Joro

<i>Experiment</i>	Molo	Orok	Kinangop	Subukia	Kitale
Cutting Back	1	1	—	—	—
Fertilizer	1	1	1	1	—
High Toxic Varieties ..	1	2	1	1	1
Interplanting	—	1	—	—	—
Ox Cultivation	—	—	—	1	—
Regeneration of Plants ..	1	—	—	—	—
Repeated Trimming	1	1	—	—	—
Rotation	—	1	—	—	—
Seedings v. Splits	1	1	1	—	—
Spacing and Cultivation ..	1	1	1	1	1
Transplanting Skill	1	—	—	—	—

In addition to these formal trials, there were several observation plots on fertilizers, blind plants, petalless plants, planting methods, etc. Altogether, the total number of separate plots is over 1,000.

It is essential, if pyrethrum is to find a permanent place in the agriculture of East Africa, that it should fit conveniently into the farming system without impairing soil fertility. A rotation trial was designed in collaboration with the authorities at Rothamsted to seek information bearing on this important question. This is a long-term experiment which will not give complete results before the end of the 10th year, although much information should accrue before this.

A start was made in the trial of selective weedkillers for use in pyrethrum. Trials are still in the preliminary stage.

The experimental year extends from April in one year to March of the succeeding year and comprises the total yields from a single growing season. The results for the 1946/47 season are not yet complete and full details cannot be given except in respect of the 1945/46 season. The following notes are based on the 1945/46 results, plus such data as are at present available for the current season:—

Effect of Phosphate.—Phosphate, applied in the planting holes, has an initial stimulatory effect but this does not usually last long and has little effect on final yields. A dense mass of roots is developed in the neighbourhood of the phosphate immediately under the young plant and this growth probably takes place at the expense of the formation of deeper roots. During dry weather such plants are apt to be more susceptible to drought.

Up to date, the drilling of phosphates between the rows of second year pyrethrum has had no effect.

Mulching.—Mulching has given increased yields in the dry season, but it is necessary to apply it towards the end of the rains. If the mulch is applied during heavy rains it depresses the yield.

Lime.—In no case has the application of lime met with any response. The lime was applied broadcast at the rate of 1,000 lb. per acre before planting.

High Toxic Variety.—The high toxic strain (14 x 24) which was issued to certain growers for bulking some years ago, is being tested at all five experimental stations. At altitudes of about 8,000 ft. it yields as well as ordinary pyrethrum. In such areas the higher pyrethrin content, larger flowers and more upright habit of growth of the high toxic strain gave it marked advantages over unselected pyrethrum. It is possible, however, that this strain is not so well suited to altitudes of 7,000 ft. or less and further investigations are being carried out to elucidate this point.

Over a series of tests the high toxic strain (14 x 24) gave an average pyrethrin content of 1.63 per cent as compared with 1.37 per cent for the control. This increased pyrethrin content represents an increased value of about 25 cents per lb. for dry flowers at present prices.

The high toxic flowers averaged 29 per cent heavier than unselected flowers. This is a point of great practical importance, since it means that the output of the picking gang is increased to a corresponding extent. The upright habit of growth also makes for easier picking and less loss through flowers becoming trampled or splashed with mud.

Interplanting.—Interplanting pyrethrum with maize or beans resulted in a decreased yield in the first year. The interplanted pyrethrum suffered severely from drought in the dry weather and the depressing effect lasted for several months after the maize and beans had been harvested. Final figures are not yet available, but it is very doubtful if interplanting is a paying proposition.

Cutting Back.—Two trials have been planted to test the effect of time of cutting back and method of cutting back. Final results are not yet available, but it appears that some sort of cutting back is essential if high yields are to be maintained. There is also some evidence that cutting back early in the dry season results in an earlier flush in the following rains.

Instead of cutting back, it is possible to break back the old, dead stalks at intervals (Repeated Trimming). Two trials have been devoted to studying this question but no marked advantage has resulted from this practice so far.

It was found that the cutting back of old plants to ground level, weeding the crowns and allowing the plants to regenerate on their original rootstocks gives a greater yield in the first season than the uprooting of the old plants and the planting of splits. Neither practice is desirable, however, as pyrethrum should be rotated with other crops and not be planted twice in succession on the same land.

Seedling v. Splits.—Splits yielded more than seedlings in the first season. At Molo, for example, the splits averaged 323 lb. per acre as compared with 204 lb. for the seedlings. The evidence so far available does not suggest that the seedlings make up for lost ground to any great extent in the second season.

Spacing and Cultivation.—It was found that close spacing gives a bigger yield in the first season. The yield for the first season at Molo illustrates this point well:—

<i>Spacing</i>	<i>Yield</i> (lb. dry flowers per acre)	
3 ft. x 3 ft.	..	292
3 ft. x 2 ft.	..	374
2 ft. x 2 ft.	..	399
2 ft. x 1½ ft.	..	508

During the second season the closer spacings have maintained their lead, but the 2 ft. x 2 ft. spacing is now drawing level with the 2 ft. x 1½ ft.

Transplanting Skill.—In the last Annual Report it was stated that differences in individual skill had an effect on the resulting stand; it has now been found that the individual transplanter affects the yield also during the first season. Splits planted by the most skilled individual yielded 330 lb. per acre as compared with only 204 lb. per acre for the splits planted by the individual with least skill. There was a corresponding difference in the yields of seedlings.

Blind Plants.—Experiments on the root pruning and cutting back of blind plants in order to induce them to flower have not been successful up to date.

Petalless Flowers.—Experiments are in progress to determine the reasons for some plants bearing flowers without ray florets. The evidence accumulated so far suggests that this condition is partly a matter of heredity and partly associated with dry weather.

General

Plant Breeding.—In July and August, the Acting Senior Plant Breeder made about 1,000 single plant selections. Some 600 of these were planted out at the Molo station, the remainder being established at Ol'Joro Orok. Towards the end of the year these selections came into flower and assistance was given to the Plant Breeder in making field observations, keeping yield records, etc.

High Toxic Seed.—Owing to the fact that the price guarantee terminates at the end of 1947, every effort should be made to ensure that the quality of Kenya's pyrethrum is kept at the highest level possible. The results of the trials made on the high toxic strain (14 x 24) were sufficiently encouraging to warrant the bulking of its seed for issue. Assistance was given in supervising the picking of seed from an area of about 50 acres situated on four farms in the Molo area. Yields were good and by the end of the year over one ton of seed had already been collected. The seed was cleaned by the Seed Specialist at Turi and dispatched to the K.F.A. for distribution early in 1947.

Bud Disease.—A new disease of the buds and flowers of pyrethrum was first seen in the Molo area in July. The disease is, apparently, associated with a fungus which has not been previously observed on pyrethrum and has not been identified as yet. Later in the season, its presence was confirmed from the Ol'Joro Orok and Kinangop districts, but the damage done in these areas was small. Around Mau Summit, Molo, Turi and Eiburgon, however, the disease was widespread and caused considerable loss.

The fungus attacks the buds, which turn brown on the outside and their contents become black and shrivelled. The stem dies back for an inch or two below the bud. Flowers are also attacked, and in this case the organism enters via the involucre bracts, which become discoloured. Flowers which are attacked when nearly mature reach the picking stage before they are severely affected. Such flowers may be almost normal or they may be somewhat smaller than usual.

The attack reached a peak in September, decreased somewhat in severity in October, but increased again in November. In December the disease abated to some extent.

Experiments were carried out to test the efficacy of spraying, cutting back and various fertilizers. It is necessary to carry out further work before coming to any definite conclusion.

Further work was done to ascertain the effect of climate on the incidence of the disease and some evidence was found suggesting that a combination of high atmospheric humidity with low minimum temperature might be a factor contributing to the spread of the disease. This work is, however, in its early stages and further observations are required.

It was observed that certain plants appeared to be comparatively resistant and this suggested that it might be possible to breed resistant strains. Some selections were made but it will be some years before these strains, if successful, can be made available to the grower. It is encouraging to note that the high toxic strain (14 x 24) appears to be fairly resistant.

Other Pests and Diseases.—A species of red spider was observed on pyrethrum for the first time in November. Although the pest was observed in several districts and was breeding on the plants, their numbers did not increase to any extent and no appreciable damage was done.

A small black beetle of the family *Nitidulidae* was observed in large numbers on a field of pyrethrum on the Kinangop. Apparently they were only feeding on pollen and no damage was done.

The Root Knot Eelworm, *Heteroder marioni*, was often found and appears to be widespread. Usually, however, it is not present in very large numbers and is not causing very severe damage.

Various cases of root rot were observed, but these were only isolated instances and there was no general outbreak.

P.A.R.A.C.—The Pyrethrum Agricultural Research Advisory Committee met three times during the year and made recommendations on a wide variety of subjects. Their advice has been greatly appreciated.

Experimental Drier.—The experimental drier designed by Mr. R. O. Barnes, Soil Engineer, for drying small samples of flowers at a constant temperature and described in the 1945 Annual Report, was completed except for the installation of a thermostat. This has to be imported and did not arrive during the year under review. The drier dries flowers in about three hours, producing samples of good colour. Complete tests cannot, however, be made until the thermostat arrives.

Agricultural Machinery.—The growing of pyrethrum involves the use of a considerable labour force and it is becoming increasingly apparent that the grower will have to mechanize his farming as much as is practicable if he is to compete successfully on the world's markets. Inquiries were made in the United Kingdom as to the possibilities of using mechanical transplanters for the planting of pyrethrum splits and seedlings. As a result, the Pyrethrum Board is importing two makes for trial in Kenya. Certain types of power cultivator are also to be tested out locally.

Farmers' Days.—Farmers' Days were held at Molo, Ol'Joro Orok and Subukia in November and December and much interest was shown in the experimental work. At Molo, the Acting Senior Plant Breeder and the Fruit Officer were also in attendance and showed the visitors round their sections. At Ol'Joro Orok, the Acting Senior Plant Breeder explained the work on his breeding plots and the Senior Agricultural Officer, Rumuruti, showed the visitors his grass experimental plots.

Thanks are due to P.A.R.A.C. for sponsoring these Farmers' Days.

Chemical Analyses.—It is very satisfactory to note that towards the end of the year some chemical assistance became available for pyrethrum analyses.

This work is of particular importance as regards the plant breeding section, but it is also necessary for a correct interpretation of the results of the field trials. Under the present arrangement the number of analyses is not sufficient for our full requirements, but it is, at any rate, a beginning and considerably better than nothing.

METEOROLOGICAL RECORDS

MONTH	MOLO				OL JORO OROK			
	Rain Total	Humidity	Max. Mean	Min. Mean	Rain Total	Humidity	Max. Mean	Min. Mean
	<i>In.</i>	<i>Per cent</i>	<i>F.</i>	<i>F.</i>	<i>In.</i>	<i>Per cent</i>	<i>F.</i>	<i>F.</i>
January ..	0.28	54	—	40.5	0.06	66	70.0	39.4
February ..	0.19	44	—	38.3	0.02	47	76.0	38.8
March ..	1.76	58	69.9	38.4	0.43	65	76.3	43.1
April ..	5.56	71	—	40.5	2.68	82	73.5	45.2
May ..	4.86	77	—	41.3	3.57	82	71.2	45.0
June ..	4.97	83	—	39.8	5.23	84	67.6	43.1
July ..	4.71	85	—	39.1	5.27	83	66.4	43.4
August ..	9.26	84	—	38.9	7.26	82	64.5	44.9
September	4.19	77	—	37.9	2.41	77	68.2	41.8
October ..	2.89	77	—	39.8	2.62	75	69.4	43.2
November	2.59	80	—	41.6	0.80	71	69.6	45.6
December	0.39	72	—	40.8	0.49	66	72.1	44.1
	41.65	72	—	39.7	30.84	73	70.4	43.1

E. W. GADDUM,
Agricultural Officer.

ANNUAL REPORT ON HORTICULTURAL WORK, 1946

Visit of Horticultural Adviser

At the invitation of the Kenya Government, Dr. R. H. Marloth, Officer in Charge, Sub-Tropical Horticultural Research Station, Nelspruit, E. Transvaal, visited Kenya to report on the potentialities for fruit production.

Dr. Marloth's visit extended from 20th January, 1946, to 25th March, 1946, during which time he toured the fruit-growing areas of the Colony, and visited scientific institutions and markets. He was accompanied on his tour by T. H. Jackson, Assistant Agricultural Officer. Dr. Marloth's findings are given in his own report.

Staff

European.—In April, T. H. Jackson, Assistant Agricultural Officer was instructed to proceed with horticultural investigations and extension work pending the appointment of a permanent horticulturist.

Africans.—An African Clerk-Instructor was engaged on temporary appointment on July 8th.

Correspondence

During the year contact was established with a number of overseas research institutions, nurserymen and commercial firms. There has been a large demand for advice on fruit-growing, and many advisory letters have been dispatched to all parts of the Colony:—

	<i>Letters</i>			
Correspondence received totalled	..	..	..	436
Correspondence dispatched	..	..	..	551

Travelling

Most districts of the Colony were visited during Dr. Marloth's tour. Many districts have been re-visited at the request of growers, or prospective growers, for advisory purposes.

The total mileage travelled during the year was as follows:—

By motor car	..	..	..	..	..	9,115
By motor cycle	..	..	..	..	..	878
Total	..	..	..	..	..	<u>9,993</u>

Meetings

Meetings of growers and prospective growers were addressed on the subject of fruit-growing in their particular areas, and methods of establishing deciduous or sub-tropical orchards. Meetings were held at the following places:—Suam Valley, Maji Mazuri, Kiambu, Turbo.

The farmers attending the Farmers' Day held at the Pyrethrum Station, Molo, were shown the newly planted experimental orchard there, and the work was explained to them. Great interest was shown in the project, and many questions were asked.

Publications

At the request of the Editor a chapter was written for the new edition of "Gardening in East Africa" dealing with deciduous fruits, soft fruits, nuts and vines in the home orchard. The article is also to be published in the *East African Agricultural Journal*.

At the request of a local nurseryman a short article was written on the cultivation of raspberries for distribution to his clients.

A short article entitled "Fruit-Growing in Kenya" was written in response to an inquiry from England.

A notice entitled "A Warning to Fruit-Growers" pointing out the dangers of allowing Italian co-operators a free hand in the pruning of local orchards was published in the K.I.O. fortnightly.

Written replies were given to several questions on fruit-growing asked in the broadcasting service from the Nairobi Station, "Farmers' Problems".

Library

A start has been made with the building up of a modern library dealing with all aspects of fruit-growing.

An index of articles dealing with fruit and vegetable culture published in agricultural and horticultural journals from all parts of the world has been started at Turi.

The Kenya Fruit Industry

Although fruit has been grown in Kenya for many years the industry has not expanded rapidly for various reasons which will be discussed below.

A New Country.—It is only a comparatively short time ago that Kenya was a new and unknown country.

The early settlers who planted fruit were working in the dark, and as was only to be expected, many of the varieties planted were unsuited to the climate, or were worked on unsuitable rootstocks.

The climate of Kenya varies widely over short geographical distances. The effect of quite small variations in climate on deciduous fruits grown in sub-tropical countries has been shown by recent research, but is still not generally known. The climatic range over which many varieties of fruit can be grown commercially in Kenya is small. Many plantings have failed owing to lack of knowledge of the climatic range of the varieties planted.

Cultivation.—A common cause of failure in the past has been the lack of knowledge on the part of growers regarding the ordinary methods of cultivation without which fruit cannot be grown successfully. A number of orchards have been seen in which the soil has hardly been cultivated since the trees were planted, neither have the trees been manured, pruned or sprayed. Many growers appear to be under the impression that once the trees have been planted their work is finished until the fruit is ready to pick.

In many cases the area planted is too small to make the control of birds by bird scarers economic; in such orchards only a small part of the crop is harvested. The provision of vermin proof fencing is another necessity which is often neglected.

Although spraying is often neglected when there is a definite need for it, it is commonly found that trees are sprayed when there is no need for it, merely because it is thought to be the correct thing to do.

Harvesting.—Many growers do not realize the necessity for handling fruit with the greatest possible care when harvesting. Failure to supervise pickers adequately, to provide them with gloves, picking bags and orchard lug boxes, results in bruising of fruit and its rapid decay before or soon after marketing. Picking fruit in the early morning when it is wet with dew is another common cause of heavy wastage.

Packing and Grading.—Some grading of blemished from unblemished fruits is done by many growers, but grading for size is unknown. As it is impossible to pack fruit properly without first grading it for size, it usually arrives on the market in a damaged condition. Alternatively an excessive amount of padding is used to counteract the loose pack, making the package uneconomic.

Packing in second hand boxes originally designed for some other product is very common, and is unsatisfactory from every point of view.

Marketing.—Before the last war prices paid for fruit tended to be low, which together with inefficient methods of production had the effect of keeping the industry in a moribund state. It must be stated however that certain growers producing fruit of good quality were able to dispose of their produce at a good profit.

Seasonal gluts on the local fruit market are very common and can be attributed to three factors:—

- (1) To the dumping on to the fresh fruit market of large quantities of inferior fruit which should have been disposed of to jam or canning plants.
- (2) To the lack of cold or gas storage facilities which could be used to extend the season of any particular fruit.
- (3) To the failure of growers to tap new markets.

In 1936 a Fruit Growers' Association was formed with the object of co-operative marketing, and purchase of fruit growers' requisites. Owing to the fact that co-operation was not made compulsory in the constitution of the Association, most of the members continued with their previous marketing arrangements, and the Association failed in its purpose.

During the war the demand for fruit was greater than the supply, and although price control was introduced and still continues, prices continue at too high a level.

As a result of the war a number of fruit packing plants sprang up producing mostly fruit cordials and squashes, jams and tomato products. Owing to the dearth of local fruit, and the high prices expected by local growers for inferior produce, much of the requirements of the packing plants were, and still are, imported from outside the Colony.

The supply of fresh citrus fruits by no means supplies the demands of the local market, and large quantities of inferior fruit are imported from neighbouring territories.

Investigational Work

A survey of the Kenya fruit industry reveals that although almost every aspect of the industry requires attention there are certain urgent and fundamental matters on which work should be started without delay.

In the opinion of the writer these points are as follows:—

"PROLONGED DORMANCY" OF DECIDUOUS FRUITS

"Prolonged Dormancy" is a term which has come into use to describe the symptoms exhibited by deciduous fruit trees when their chilling requirements are not satisfied. This condition occurs when deciduous fruit trees are not subjected to sufficiently low temperatures during their dormant season. Affected trees are characterized by irregular opening of flower and leaf buds. Large numbers of buds may remain dormant throughout a whole growing season. In severe cases the flower buds drop without opening, or the fruit fails to set.

Much research has been done on this problem during recent years in the United States of America, in South Africa and in Palestine. Research has taken

two lines. The breeding of new varieties whose chilling requirements are easily satisfied, these may be described as sub-tropical varieties. Inducing the artificial breaking of the dormant period by spraying the trees with organic or mineral oils.

In South Africa good results have been obtained by spraying with an emulsion of raw linseed oil, during the dormant season, a few weeks before the trees are due to flower. The time of application is critical.

Preliminary trials were carried out this year on several orchards using a five per cent emulsion of raw linseed oil. Results were as follows:—

Molo Experiment Orchard (altitude 8,300 ft.), date of application 27th August, 1946.—The trees were inspected on 18th September, 1946, and favourable reaction to the spray was noted on Keiffer Pear, Plum Shiro, Apricot Blenheim. No reaction was observed on apples.

As this orchard had been planted for a few weeks only, the results are by no means conclusive.

Kabazi Estate, Subukia (altitude 7,600 ft.), date of application, 16th August, 1946.—The trees were inspected on 26th September, 1946. The following plums reacted strongly to the spray, Methley, Satsuma, Santa Rosa. The sprayed trees were flowering heavily, but the control showed scattered flowering only.

Young apple trees also reacted favourably; a count of buds breaking on sprayed and control trees gave the following result:—

Sprayed				Control			
Tree A	..	..	61	Tree D	..	..	8
Tree B	..	..	50	Tree E	..	..	1
Tree C	..	..	82	Tree F	..	..	14
Total Sprayed	..		193	Total Control	..		23

Bryn Glas Estate, Ol Joro Orok (altitude 9,000 ft.), date of application, 22nd August, 1946, on apples only.—There was no visible reaction to the spray possibly due to the fact that at this altitude (9,000 ft.), the trees do not suffer so much from "prolonged dormancy".

J. F. Rousseau's Orchard, Lessos (altitude 7,300 ft.), date of application, 9th September, 1946.—The trees were inspected on 9th December, 1946. The reaction of Japanese plums, apples and quinces was very marked.

The plums and quinces were carrying heavier crops than usual, and the number of leaves per tree was greatly increased.

The results of these preliminary trials are promising; it is hoped to carry out more extensive trials in 1947.

With regard to the breeding of sub-tropical varieties; in California a number of sub-tropical peach varieties have been produced, one of which, Babcock, is under trial in Kenya; it is hoped to import others for trial.

Some of the early settlers on the Plateau brought with them from South Africa, peach seed, which has resulted in several fairly large orchards of seedling peaches there. Most of these peaches appear to be highly resistant to "prolonged dormancy". A search amongst this mass of material would probably bring to light outstanding types well suited to the climate, and suitable for canning. A canning peach resistant to "prolonged dormancy" is badly needed in Kenya.

Different kinds and varieties of fruit vary greatly in their chilling requirements. It is on a knowledge of the chilling requirement of each variety, and on the climate of each district that recommendations regarding the varieties to be planted in new orchards must be based.

ROOTSTOCKS

In the case of apples, and to a lesser extent of pears and plums the problem of rootstocks is as great as that of "prolonged dormancy".

It will be necessary also to carry out citrus rootstock trials but this is less urgent.

In the past the rootstock most commonly used for apples in Kenya was Northern Spy. This rootstock has the advantage of being highly resistant to attack by Woolly Aphis, but owing to the fact that it produces a dwarf, slow growing, and not very productive tree in this climate, it is now considered unsuitable for local use.

Two other rootstocks have been used here for apples, they are Crab; and Cape Seedling. Both produce vigorous trees, but as the stocks are propagated by seed, trees grafted on them are variable in growth and cropping. Neither is resistant to Woolly Aphis attack, but as this pest is now controlled satisfactorily by biological means, resistance is not of great importance.

Pending the results of trials of East Malling clonal, and other rootstocks it is recommended that new plantings of apples should be worked on Crab or Cape Seedling rootstocks.

The clonal apple rootstocks imported from East Malling Research Station in 1945, and planted at the Turi high altitude nursery have now made considerable progress. It has been possible to eliminate some rootstocks as unsuited to the climate, whilst a start has been made with vegetative propagation of those which are more promising. A detailed report on the latter is given below.

Malling Immune 10.—Made very vigorous growth. Plants have produced shoots up to four feet long in one season.

Malling Immune 12.—This is the most vigorous of the East Malling stocks at Turi; it has made shoots up to five feet-long in one season.

Malling XIII.—One plant produced a shoot four feet long in one season, but this stock is much less vigorous at Turi than Immune 10 and 12.

Malling Immune 411.—This stock made shoots up to 18 in. long in one season. It is less vigorous than the three preceding stocks.

Number of Rooted Layers Propagated:—

<i>Rootstock</i>	<i>No. of Rooted Layers.</i>							
Immune 10	..	..	..	..	..	..	..	127
Immune 12	..	..	..	..	..	..	..	51
Malling XIII	..	..	..	..	..	..	..	11
Immune 411	..	..	..	..	..	..	..	23
Quince "A"	..	..	..	..	..	..	..	10

The rooted layers will be grafted with various apple varieties for trial in September, 1947.

In addition to the above, Mr. Sherwen of N. Kinangop has grafted on Immune 10, 12, 411 and Malling XIII, a total of 20 trees, with the Gravenstein variety. These trees will be planted out for trial in July, 1947.

We have been promised a further consignment of rootstocks from East Malling early in 1947.

The Western Province Fruit Research Station, Stellenbosch, have promised to send for trial a consignment of Apple, Pear and Plum trees grafted on to various clonal rootstocks in 1947.

I should like to place on record my grateful thanks to the Director of the East Malling Research Station and the Western Province Fruit Research Station for the help they have given in establishing rootstock trials in Kenya.

ESTABLISHMENT OF EXPERIMENT ORCHARDS

The establishment of experiment orchards in various parts of the country is essential for research in fruit growing.

This year the first of these orchards was planted at the Pyrethrum Experiment Station, Molo.

Arrangements are in train for planting an experiment orchard at the new Agricultural Station at Ol Joro Orok in 1947.

At Molo approximately two acres were planted this year; planting will continue as new material becomes available. The present planting consists of four tree plots of Apple, Pear, Apricot, Plum, Peach and Almond varieties. Owing to the slope of the land the orchard has been semi-bench terraced, and the tree rows follow the contour.

Raspberries and Strawberries have also been planted at Molo.

COLD STORAGE

A small experiment on cold storage of Keiffer pear was carried out in co-operation with Mr. J. H. Simpson of Molo, and The Kenya Cold Storage Co., Nairobi.

The pears were properly packed in standard boxes; three methods of packing were tried:—fruit unwrapped, each fruit wrapped in tissue paper, and each fruit wrapped in greaseproof paper.

The fruit was graded for size and ripeness:—

5 cases were held at 22–30° F. for six weeks.

15 cases were held at 40° F. for six weeks.

At the end of the storage period the fruit was unpacked for examination. Most of the pears were over ripe, and some wastage had occurred through blue mould. There was a considerable amount of surface browning.

The unwrapped fruit stored much better than the wrapped.

Possible causes of failure are as follows:—

Fruit too ripe when placed in storage.

Careless picking resulting in bruised fruit.

Too great a variation in temperature in the low temperature storage (30° F. is considered optimum for pears).

Period of storage too long.

Incorrect relative humidity.

It is hoped to carry out further trials in 1947.

TRIAL OF NEW KINDS AND VARIETIES

Many new varieties of sub-tropical and deciduous fruits remain to be tried out locally, particularly varieties of deciduous fruits specially bred for sub-tropical conditions. There are, however, two kinds which have been planted hardly at all locally and which should be tried as soon as possible, they are the cultivated varieties of the Avocado and the Pecan nut.

The named varieties of avocado are very superior to the West Indian seedlings commonly grown locally; they have usually about twice the oil content, are tight seeded, which makes them exportable, and have an extended season.

The Pecan nut is becoming increasingly popular throughout the world and there is a very large demand for it, for use fresh, and in confectionery.

Trials of Avocado and Pecan varieties will be undertaken as soon as trees can be obtained.

Extension Work

New Fruit Acreage.—There is no doubt that interest in fruit growing is very much on the increase. Interest has been stimulated by Dr. Marloth's visit, and by an officer being available to advise interested persons on fruit-growing.

During the year I have been called in to advise on the planting of the following new acreages of fruit:—

<i>Kind of Fruit</i>	<i>No. of Growers</i>	<i>Acres</i>
Deciduous	25	225
Sub-tropical	20	235

Soil Conservation.—In all cases growers have been advised to plant their fruit on the contour. On steep slopes and where irrigation is to be used, bench terracing has been advocated. On gentle slopes, narrow-base terracing, with the tree rows following the contour is recommended.

Valuable help has been given by officers of the Soil Conservation Service in working out a technique for laying out orchards on the contour, and laying out orchards for growers.

Supply of Fruit Trees.—Fruit trees are in short supply all over the world, but the supply of trees propagated locally is very small indeed. In the case of the new plantings mentioned above most of the trees will be purchased from South Africa. This is hardly a desirable situation in view of the danger of importing pests and diseases with the trees. At present only one local nurseryman has locally propagated trees for sale, but every effort is being made to induce local nurserymen to propagate fruit trees, and it is hoped that in a year or two there will be six or seven nurserymen selling locally propagated trees.

Preparation of Fruit for Market.—The preparation of fruit for market, or rather the lack of it, is a disgrace to the Kenya fruit industry. The introduction of grading standards, and standardization of fruit packages are essential if gluts of inferior quality fruit on the market, and heavy wastage due to fruit being damaged in transit, are to be avoided.

A start has been made with this work, but some time must elapse before a general rise in standards of preparation becomes apparent.

Much has been done, and remains to be done, by means of propaganda and demonstration to growers.

Recently a detailed scheme was submitted to the Price Controller to retain the present maximum control price of various fruits for properly packed and graded fruit only, and to scale down prices for all fruit not conforming to the standards set. If this scheme is adopted, the use of proper methods of packing and grading by growers would be much accelerated.

Specifications and quotations for all the standard South African fruit packages were obtained from firms in South Africa. The East African Timber Co-operative Society have been able to submit lower quotations for the same specifications for each type of package. Standard fruit packages of all types are now, therefore, available locally at reasonable prices.

With regard to grading appliances; it is not easy to obtain grading machinery from overseas, and the following steps have been taken to make some simple appliances available locally.

Pattern grading boards have been made for tomatoes, apples and pears; with slight modifications these boards can also be used for oranges, lemons and grapefruit.

The patterns were submitted to Messrs. Dalgety's of Nakuru, who undertake to make boards to the order of growers at a reasonable price.

A simple mechanical grader working on the Helix principle is under construction. It will be possible to manufacture this machine locally, and it should be suitable for grading plums, citrus fruits, tomatoes, apples.

An improvement in the standard of locally produced woodwool is desirable, and it is suggested that this might be a subject for investigation by the Forest Department and the East African Timber Co-operative Society.

Marketing.—It cannot be said that fruit marketing is on a satisfactory basis as neither producer, retailer nor consumer is satisfied. The producer complains of seasonal gluts; the retailer of heavy wastage and unreliability of supply and quality; the consumer of unduly high prices and poor quality.

As stated above, some of these complaints can be remedied by better methods of preparation.

With regard to seasonal gluts; these are partly the result of unenterprising marketing on the part of the growers, partly due to lack of cold storage facilities, and partly due to restriction of fruit sales resulting from the extremely high prices fixed by the Price Controller.

Unenterprising marketing means failure to exploit markets in neighbouring and overseas territories, and failure to produce a product of the quality required by these markets, or even by the local market.

Cold storage facilities have been meagre in the past, but one grower is now installing his own cold store, and I know of a local firm who are willing to erect a cold store for fruit in Nairobi if sufficient support from growers is forthcoming. A recommendation has been submitted to the management of the K.U.R. and H. to make part of their proposed new cold store at Kilindini suitable for fruit storage.

Price Control of fruit has worked in an unfortunate way; very high maximum prices have been fixed for each kind of fruit, and although there has been some attempt to distinguish between varieties, no other effort has been made to place a premium on quality. The result has been to keep prices for fruit of all qualities at a very high level, with a corresponding reduction in sales.

It is realized by progressive growers, retailers and consumers that the time has come for a revision of fruit prices in a downward direction.

Fruit Growers' Associations.—In the opinion of the writer the formation of local or district Fruit Growers' Associations, with the object of co-operative marketing of their members' fruit would do much to stabilize supplies to the fresh market and to packing plants. Stabilized supplies mean stabilized prices, and all concerned would benefit.

It is probable that at least two such Associations will be formed in the near future. Later when the industry is considerably larger, such local Associations could be affiliated to a central organization which would be largely concerned with the development of an export trade. There are other functions which could be undertaken by district Associations, in addition to marketing.

Such operations as packing, spraying and picking and the purchase of fruit growers' requisites can all be done on a co-operative basis. How many of these operations can be carried out co-operatively in any particular district will depend on the geographical distribution of the growers.

The Packing and Processing Industry

Owing to the difficulty of importing fruit cordials and squashes, jams, canned fruits and vegetables, etc., during the war, the local industry was greatly stimulated. As stated earlier in this report, much of the raw material had to be imported from neighbouring territories. It is for local growers to decide whether this state of affairs should be allowed to continue.

The packing industry supplies a very useful outlet for fresh produce which is not of the standard required by the fresh market. This does not mean that the processor will accept rubbish. Sound fruit with surface blemishes, or of small size is suitable, and if this is offered to packing plants *at a reasonable price* the stacks of rotting fruit on the fresh market during seasonal gluts will disappear.

There is no reason why this country should not develop an export trade in packed fruit and vegetable products, in fact one factory was carrying on an export trade before the war.

Fruit-growing in Native Areas

In the native areas it has been the policy of this Department to encourage fruit-growing by the propagation and distribution of fruit trees to landholders. This has resulted in many thousands of trees being planted, but lack of care after planting is responsible for a large percentage becoming unprofitable or dying.

If a small charge is made for the trees, when they are distributed, as is the case in some areas, the grower values them, and is more likely to care for them. In every district where it is possible to grow fruit there should be at least one native Instructor whose sole work should be to see that fruit trees in that area are properly cared for.

In most districts the fruit produced is quite insufficient to supply the needs of the population but such fruit unfortunately, often finds its way to markets in the settled areas. The export of fruit from districts where deficiency diseases are rampant amongst the population should be discouraged.

Kinds of Fruit Recommended.—With the exception of areas specially suited to fruit-growing such as the Coast, the kinds of fruit grown in native areas should be hardy, and capable of survival under difficult conditions.

Citrus fruits should be seedlings and not budded trees. The latter are comparatively difficult to grow, and unless regularly desuckered will revert to the rootstock.

Plums and Keiffer pears should be grown on their own roots; they may be readily struck from cuttings. Seedling guavas, avocados and mangoes are all hardy and will survive with the minimum of care.

In the case of the Coast and similar areas fruit is, or will be, regarded as one of the main cash crops, and as such it is necessary to grow the best commercial varieties, and to see that they get the care and attention which is necessary for commercial production.

Practical Propaganda.—In order to increase consumption of fruit by natives and to encourage them to plant fruit trees of their own it is recommended that every administrative post should have an orchard representative of the kinds which can be grown in the district.

Fruit trees should be planted round Government rest camps, in native markets, and anywhere where natives meet in the reserves.

In the settled areas fruit trees should be planted at native hospitals and native locations.

Employers should be encouraged to plant fruit for their labour where situated in a suitable climate.

APPENDIX "A"

IMPORTATIONS OF FRESH FRUIT INTO KENYA THROUGH MOMBASA

Origin	Kinds	Number of Packages	Value
			<i>Sh.</i>
East African Coastal Ports	Oranges, Pineapples, Mangoes, Bananas	69,954	548,941
South Africa ..	Apples, Grapes, Melons, etc.	20,054	687,974

APPENDIX "B"

*IMPORTATION OF FRUIT TREES INTO KENYA THROUGH MOMBASA

Origin	Number of Packages	Value
		<i>Sh.</i>
Mainly South Africa but some from England ..	301	43,380

* Trees imported in postal packages not included.

T. H. JACKSON,
Assistant Agricultural Officer.

ANNUAL REPORT OF THE GRADING, INSPECTION AND COOL STORES SERVICES, 1946

Staff

Mr. Taylor, Mechanic, Cool Stores, returned from overseas leave on 1st January.

Mr. Beverly, Grader and Inspector, returned from overseas leave on 26th January and was seconded to the Maize Control for duty up country from 23rd February to 4th March and from 4th July to 12th July.

Mr. Quiggin, Acting Chief Grader and Inspector proceeded on overseas leave on 28th September.

Mr. Beverly was gazetted Acting Chief Grader and Inspector as from 30th September, 1946.

Oliech Aboya—Headman—Maize Conditioning Plant retired on 9th January after twenty years service at the Conditioning Plant.

Inspection

Exports.—The following Phytopathological Certificates were issued:—

5 certificates for 2,614 bags of different species of grams from Uganda to Colombo.

4 certificates for 1,711 bags of chillies from Uganda to Egypt, Colombo and America.

2 certificates for 2,237 bags of soya beans from Uganda to Port East Africa.

1 certificate for 1,311 bags of Congo coffee to Palestine.

2 certificates for 30 packages miscellaneous.

In four cases certificates were refused for Uganda chillies and capsicums owing to the presence of unreasonable quantities of earth and dust as well as storage pests—mainly *Triboleum* and *Oryzaephilus*.

Imports.—The following table shows the number of parcels of seeds, plant material and plant products with their declared values inspected at Mombasa:—

Class of Import	Plant Imports		Refused entry:	
	Imported:		No. of Declared value	
	No. of parcels	Declared value	No. of parcels	Declared value
		Sh.		Sh.
Seeds	665	80,656	—	—
Tea seed	518	91,280	—	—
Plants	8	363	5	226
Bulbs	2	57	7	92
Fruit—apples	20,054	687,974	156	4,861
Fruit—other	69,954	548,941	—	—
Fruit trees	301	43,830	—	—
Food and spices	30,277	2,476,417	—	—
Drugs	2,383	191,918	—	—
Miscellaneous	1	58	—	—
Totals	124,163	4,121,504	168	5,179

475 packages valued at Sh. 56,879 were passed on behalf of Uganda.

65 packages valued at Sh. 5,302 were passed on behalf of Tanganyika.

The resumption of more normal post-war conditions of trade is reflected in the increased quantities in almost all types of plant imports. This is especially so in the case of apples and fruit trees from South Africa.

In August, a record consignment of 242 packages of fruit trees valued at nearly £2,000 was imported.

There has also been a large increase in small parcels of seeds and bulbs accompanying immigrant passengers. An officer of this section has always been on duty during the Customs examination of passengers baggage and prohibited imports have been confiscated.

Grading

Maize.—Owing to the shortage of internal food supplies and the necessity of conserving cereals for famine relief, no maize was inspected direct for export. In January, 1,145 bags were graded K8.C.W. after treatment at the Conditioning Plant and shipped to Durban, one certificate being issued for this consignment.

This negligible amount constitutes an all time low record since the service was started.

The following table shows the amounts of maize exported to local ports under Rule 25:—

							Bags
Dar es Salaam ..	..	..	..	..	..	..	103,169
Mogadishu ..	..	..	..	..	..	..	3,700
Seychelles ..	..	..	..	..	..	..	18,011
Tanga ..	..	..	..	..	..	..	66,971
Total ..	..	..	..	..	..	..	191,851

Beans

(a) Commercial:

Grading.—With the exception of one consignment received in July, all beans graded during the year were received in the first five months and were from the 1945–1946 crop.

The following table gives details:—

Variety	K2	K3	K5	Total graded	Rejected	Total presented
Canadian Wonder..	—	504	284	788	—	788
Rose Coco ..	—	267	2,083	2,350	—	2,350
White Haricot ..	279	2,121	1,481	3,881	—	3,881
Soya	—	1,203	2,001	3,204	—	3,204
Madagascar Butter	—	390	—	390	—	390
Lima	112	3,004	1,289	4,405	7	4,412
Mixed	—	—	1,078	1,078	—	1,078
Totals ..	391	7,489	8,216	16,096	7	16,103

The large white Lima beans have appeared on the export market for the first time during the year. Their quality, in common with all of the other types can be described as fair only. More careful hand-picking of diseased and beetle damaged beans would have resulted in a larger proportion being placed in the higher grades.

Shipment under certificate.—49 certificates in respect of 11,813 bags were issued, the following table giving particulars. The balance of the graded beans were either used for local consumption or exported to coastal ports.

Variety	K2		K3		K5		Totals	
	Certs.	Bags	Certs.	Bags	Certs.	Bags	Certs.	Bags
Canadian Wonder ..	—	—	4	330	4	322	8	652
Rose Coco ..	—	—	3	267	9	1,646	12	1,913
White Haricot ..	1	279	4	2,341	7	1,781	12	4,401
Soya ..	—	—	—	—	4	2,030	4	2,030
Madagascar Butter ..	—	—	—	—	—	—	—	—
Lima ..	—	—	7	1,640	4	750	11	2,390
Mixed ..	—	—	—	—	2	427	2	427
Totals ..	1	279	18	4,578	30	6,956	49	11,813

Under Rule 15 (to local ports):—

							Bags
Dar es Salaam ..	..	..	..	..	..	..	6,482
Tanga ..	..	..	..	..	..	..	1,763
Zanzibar ..	..	..	..	..	..	..	3,808
Total ..	..	..	..	..	..	..	12,053

(b) *Seed Beans:*

Grading.—As is now usual with this commodity, all the seed beans for export which were received at Mombasa, came from the Kilimanjaro district of Tanganyika Territory, where an established seed bean industry thrives. At the request of the growers, backed by the authority of the Honourable Director of Agriculture of Tanganyika these beans are not subject to the provisions of the Kenya Agricultural Produce Export Ordinance and are only treated or graded by this section at the request of the owners. Only three requests for grading were received for a total of 398 bags which were graded as follows:—

							Bags
K1 ..	..	..	..	..	..	..	150
K2 ..	..	..	..	..	..	..	150
K3 ..	..	..	..	..	..	..	98

The de-grading was caused by beetle damage.

The whole crop was fumigated by request and certificates were issued to this effect:—

84 certificates in respect of 7,235 bags being issued, of this amount, 22 bags were shipped to Australia and 1,010 to Antwerp, the rest going to the United Kingdom and South Africa.

Potatoes

Grading.—The year opened with fairly large exports to Colombo in January. During February exports fell to a small figure to local ports only and entirely ceased during the next three months. In June new crop potatoes started to arrive at the coast for export and small quantities continued to be exported every month for the rest of the year. With the exception of small shipments to Aden, Mauritius, the Persian Gulf and Seychelles, the entire exports were made to East African Coastal ports only; during August a consignment of about 500 tons being shipped to Dar es Salaam for famine relief.

It is a regrettable but increasingly obvious fact that the quality of Kenya potatoes offered for export continues to deteriorate to an alarming degree. Bacterial rot is prevalent in potatoes coming from nearly all the dispatching stations and the keeping qualities thereby impaired to such an extent that any large scale export to overseas ports is no longer an economic proposition. On several occasions trucks of potatoes kept in the transit shed for ten days have putrefied so badly that at least 50 per cent are not fit for human consumption. This period is about the same as ship's passage to Indian ports and the conditions of storage in the transit sheds are vastly superior to those found in a ship's hold.

To a large extent this deterioration is caused by bad handling and packing of the crop by the producers. Potatoes are lifted before the skins are properly set and the immature tubers exposed to the sun. Hand-picking of diseased or mechanically damaged potatoes is not efficiently carried out and the bagged crop exposed to rain before it reaches the station.

The fact that the percentage of rejections is comparatively small is accounted for by a considerable relaxation of grading regulations for exports to coastal ports especially where famine relief is concerned.

The following table gives details of exports:—

<i>Port</i>	<i>Amount</i> <i>cwts.</i>	<i>Grade</i>
Aden	3,358	K2
Bahrein	200	K2
Colombo	10,160	K2
Dar es Salaam	29,005	K2
Lindi	56	K2
Mauritius	2,071	K2
Mogadishu	300	K2
Seychelles	2,198	K2
Tanga	1,435	K2
Zanzibar	10,757	K2
Rejected	2,240	—
Total presented ..	61,780	

Ships' Stores.—6,480 cwts. were exported as Ships' Stores.

Wheat

No wheat was received for export during the year.

Conditioning

The Conditioning Plant worked a total of 953 hours during the year, made up as follows:—

	<i>Part days</i>	<i>12 hours shifts</i>	<i>24 hours shifts</i>
No. 1 plant	9	53	Nil
No. 2 plant	2	22	Nil

The following produce was treated:—

								<i>Bags</i>
Maize	..	..	..	..	..	..	..	21,840
Beans	..	..	..	..	..	..	..	19,502
Cow peas	..	..	..	..	..	..	..	2,019
Total	..	..	..	..	..	..	..	43,361

The above total was entirely in respect of treatment for the destruction of weevil pests, no wet grain having been received.

After the heavy work done in 1945 and the early months of 1946, considerable repairs were necessary to the plant. These were carried out as soon as possible and were finished by the end of June. Since then only a few thousand bags of beans have been treated.

Nairobi Grain Conditioning Plant

No work was carried out at the Nairobi Grain Conditioning Plant during the first two months of the year. During March and April, three Datura extracting machines for cleaning wheat were installed by the Maize Controller and were in use until the end of May. This work was carried out and paid for by the Maize Controller under the supervision of the Superintendent, the premises being lent by the Department.

During July it was found necessary to add wheat flour to the mixed meal issued to Africans in Nairobi. The Datura extracting machines were unable to cope with this increased demand as wheat for famine relief was demanding their total output and the Department's help was asked. A European Grader from this section proceeded to Nairobi to ascertain if it was possible to certify wheat as free from Datura by ordinary sampling and inspection. It was decided that it was impossible to state wheat to be clean without a very careful inspection of the whole bag which would take too long to be a practical proposition. It was then found possible to fit the Milling Separator with special screens which would extract sufficient Datura to render the wheat safe for consumption and work was started immediately. The cost was again met by the Maize Controller.

This work closed in the middle of August and the plant was idle until 13th November, when work started on conditioning maize from Uganda. This work was still being done at the end of the year.

The following table shows the amount of grain treated:—

								<i>Bags</i>
Maize conditioned	..	..	..	..	..	..	..	17,314
Wheat conditioned	..	..	..	..	..	..	..	194
Wheat treated for Datura extraction	..	..	..	..	..	..	..	56,646

Fumigation

12,061 bags of grain were fumigated in 82 operations as shown by the following table:—

					<i>Bags</i>	
Seed beans	..	..	..	..	9,140	in 57 operations
Commercial beans	..	..	..	..	1,705	in 16 operations
Miscellaneous	..	..	..	..	1,216	in 9 operations

Owing to the lack of Carbon Bisulphide, Ethyl Dichloride Carbon Tetrachloride mixture was used throughout the year. It is hoped to obtain stocks of the former type of fumigant again shortly.

Cool Stores

The following table shows the total quantities and revenue earned from the various commodities deposited in the store during the year:—

<i>Commodity</i>	<i>Deposits</i>				<i>Revenue Sh.</i>
Mutton	145,905 lb.	..	..	..	8,073/00
Beef	390,363 lb.	..	..	..	23,558/47
Pork	290,886 lb.	..	..	..	20,232/14
Offal	78,983 lb.	..	..	..	3,405/38
Bacon	212,490 lb.	..	..	..	8,504/36
Cheese	44,041 lb.	..	..	..	1,483/23
Fruit	338,685 lb.	..	..	..	10,383/97
Poultry	6,560 lb.	..	..	..	381/96
Fresh fish	5,125 lb.	..	..	..	151/80
Cured fish	5,280 lb.	..	..	..	501/86
Miscellaneous	514 lb.	..	..	..	68/14
Eggs	903 doz.	..	..	..	59/90
Local butter	1,864 cases	..	..	..	3,985/56
Butter store	30.211 cases	..	..	..	20,090/00*
Total ..	1,560.2 tons	..	..	..	100,879/77

*Includes rent of butter store

In spite of further reduction in Service personnel stationed in Mombasa and the consequent reduction in the space demands by the Services, the total weight of deposits has been nearly 50 per cent greater than that of 1945, although the revenue earned is only 3.5 per cent higher. The bulk butter store is responsible for this apparent anomaly. The deposits of butter in the store have increased by 62.4 per cent over the 1945 figure but the revenue from that source remains the same, as the butter store is leased at a flat annual rental by the Kenya Co-operative Creameries, Ltd. The greater facilities for shipping coupled with reduction in local consumption are partly responsible for this rise in the butter figures.

The increased flow of shipping through the port has given an impetus to the ships' store trade which accounts for increases in the fresh meat and cheese deposits.

Bacon has also risen, due to increased production and the opening of an export market to India. For the first time since 1941 imported cured fish has been accepted for storage and small deposits of fresh fish have been made.

Owing to the partial return of pre-war shipping facilities, the deposits of imported fruit from South Africa have increased nearly fourfold.

The plant continued to give satisfaction. The whole installation has been worked by No. 2 compressor which ran for the whole year on 24 hour shifts without a single involuntary stoppage, a tribute to the careful maintenance of mechanical staff of the Cool Store.

Finance

Owing to the decrease in export of foodstuffs and the consequent lack of revenue from Grading and Conditioning, the section shows a considerable loss on the year's working. This loss is aggravated by the inclusion of the Nairobi Grain Conditioning Plant figures.

Acknowledgments

Acknowledgments are due to the Railways and Harbours Administration and the Kenya Landing and Shipping Co., for their continued and helpful co-operation in all works at the Port.

M. BEVERLY,
Acting Chief Grader and Inspector.

EXPENDITURE			REVENUE		
	<i>Sh.</i>	<i>cts.</i>	<i>Sh.</i>	<i>cts.</i>	<i>Sh.</i>
Salaries :—					
Grader and Inspectors ..	19,707	55	Grading :—	34	35
Clerks ..	2,120	67	1,145 bags Maize at 03 cts.	825	05
Africans ..	1,709	81	16,501 „ Beans at 05 cts.	6,228	20
			62,202 cwt. Potatoes at 10 cts.		
Sundry Expenses	301	35			7,087
Labour (Fumigation) ..	434	00	Fumigation :—		
Fumigation Sundries ..	5	30	Expenses recovered ..	..	..
			Balance, being Excess of Expenditure over	..	1,900
Travelling ..	..	..	Revenue ..	..	16,126
					58
					25,114
					18

PLANT INSPECTION

EXPENDITURE			REVENUE		
	<i>Sh.</i>	<i>cts.</i>	<i>Sh.</i>	<i>cts.</i>	<i>Sh.</i>
Salaries :—					
Grader and Inspectors ..	16,422	90	Phytopathological Certificates	..	..
Clerks ..	1,282	67	Balance being Excess of Expenditure over	..	140
Africans ..	181	50	Revenue ..	..	00
					19,059
Travelling ..	..	..			56
					19,199
					56
TOTAL EXPENDITURE ..		<i>Sh.</i>			
					19,199
					56

APPENDIX C

SUMMARY, 1946

SERVICE	EXPENDITURE	REVENUE	PROFIT	LOSS
	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>
Grading	25,114 18	8,987 60	—	16,126 58
Plant Inspection .. .	19,199 56	140 00	—	19,059 56
Conditioning : Nairobi ..	72,120 00	12,461 20	—	59,658 80
" Kilindini ..	54,902 69	26,985 02	—	27,917 67
Cool Stores	81,854 34	98,479 77	16,625 43	—
<i>Sh.</i>	253,190 77	147,053 59	16,625 43	122,762 61

STATEMENT OF BALANCES AS AT 31st DECEMBER, 1946

GRADING AND CONDITIONING COMBINED		<i>Sh. cts.</i>	<i>Sh. cts.</i>
Combined Credit Balance as at 31st December, 1945 ..		—	27,721 19
Less Loss on Grading, 1946	16,126 58		
Loss on Conditioning, 1946 (K.L.) ..	59,658 80		
Loss on Conditioning, 1946 (N.B.I.) ..	27,917 67		
COMBINED DEBIT BALANCE as at 31st December, 1946 ..		..	75,981 86

APPENDIX D

COOL STORES

EXPENDITURE			REVENUE		
	Sh.	cts.		Sh.	cts.
Salaries :—					
Manager	10,948	31	Storage Charges ..	..	..
Superintendent and Mechanic (E)	26,832	21	Rent of Butter Store ..	..	..
Clerks	4,241	33	Less Rent of Godown ..	..	..
Mechanics (Asian)	13,167	96		20,000	00
Africans	7,035	25		2,400	00
Travelling					
Sundry Expenses :—					
Power	15,144	63			
Water	442	50			
Ammonia	1,336	00			
Sundries	2,042	65			
Balance being Excess of Revenue over Expenditure	18,965	78			
	16,625	43			
	98,479	77		Sh.	98,479 77

Capital Cost at 31st December, 1946, £11,993 10 92cts. plus cost of Butter Store.

No provision is made for interest on Capital or Depreciation in the above statement.

ANNUAL REPORT OF THE PRINCIPAL, EGERTON SCHOOL OF AGRICULTURE, 1946

Preparation of Accommodation Required for the Full Agricultural Training Scheme

The alterations and additions to the buildings which had been decided in 1945 went steadily ahead. Delays from lack of various essential requisites, such as shingles, cement, window and door frames, held up progress occasionally.

The following buildings were completed or started:—

- (a) Dining room block enlarged with another common room; an extension to the dining room itself and a new and large kitchen complete with stores and pantry. The new kitchen was not, however, in use at the end of the year owing to the lack of stove fittings.
- (b) The partitioning of dormitories in Blocks A and B was completed. This alteration permits up to three students to occupy each of the seven rooms in each block.
- (c) Block D was completed. It consists of two prefabricated buildings each of six rooms, and a third prefabricated building contains four bathrooms and store rooms. There is also a prefabricated concrete house for the staff.
- (d) A new Class IV staff house was started.
- (e) A large extension to Block C was started towards the end of the year.
- (f) An office at the main entrance to the farm was built for the Veterinary Officer.
- (g) Minor works include two buildings for married African staff and two more started in the School camp.

An Engineering Workshop was completed and some equipment installed.

- (h) Farm buildings are detailed under "Farm—Buildings".

Preparation for Agricultural Tuition

In view of the number of settler-students, expected orders for considerable equipment, including books, farm machinery, workshop equipment, laboratory equipment, were placed but, owing to the general shortage of materials, much equipment ordered had not arrived by the end of the year.

A library was started and arrangements made to collect about 800 books from the Waterkyn Farm at Kitale.

A representative selection of periodicals, pamphlets, bulletins and text books arrive regularly.

At the end of this year all vacancies on the staff, with the exception of one post of Instructor, had been filled.

Land Development

A further 60 acres were cleared, stumped, ploughed and broad-base terraced.

Most of this new land was brought into cultivation; only 35 acres of the farm remains to be cleared.

Water and Light Supply

The equipment for the borehole arrived and was erected. The discharge is now at the rate of approximately 1,000 gallons per hour.

The station has been supplied by the East African Power and Lighting Co., Ltd.

European Staff

Principal.—J. E. P. Booth was in residence during the year.

Vice-principal.—T. L. McClelland was seconded on 3rd March, 1946.

Farm Manager.—B. H. Robson was in residence during the year.

Engineer.—K. B. Bindloss was in residence during the year, and until August combined the duties of Warden.

Warden.—C. A. Thornton took over the duties of Warden in August.

Instructors.—P. Ward was appointed as Instructor and arrived on 26th February. C. A. Thornton was appointed and arrived on 14th April. J. Kean was appointed and arrived in August. M. A. Barrett, Agricultural Officer, arrived from England on 1st October and was posted to the School.

Veterinary Officer.—J. M. Macaulay was posted to the School in July.

Secretary.—Mrs. J. M. Robson was in residence during the year.

Housekeeper (School).—Miss Grant left in September and Mrs. Bindloss took over. Miss Tytler was appointed in October.

Housekeeper (Hostel).—Mrs. Gleadow was appointed and Miss Wilcox was appointed.

Resident Nurse.—Mrs. Thornton was appointed in July.

Medical Officer.—Dr. Scott, the wife of a student, arrived on 27th July and was appointed Medical Officer.

The Hostel

The Njoro Hostel for new settlers was taken over by the School from the E.A.W.L. and provides accommodation for settler-students and their wives and children.

Agricultural Training in 1946

There were two Army prevocational courses held from 4th February–5th March and from 19th March–12th April.

In May, the first of the new settler-students began to arrive, but owing to shipping difficulties the first course for these students did not officially start until 8th July.

There were 40 settler-students and 7 officers of the Soil Conservation Service and African Settlement Service in training from July until the end of this year. This course will end in February, 1947.

Students' wives and children were living at the School and Hostel.

The course started on 8th July and there was a short break from 5th October to 27th October, during which period a tour of the Eldoret–Kitale area was undertaken to enable prospective settlers in that district to see land available under the Settlement Scheme.

Other tours were arranged to enable students to see farming methods in the Trans Nzoia and Uasin Gishu.

When the course started it was intended that only men in training should live at the School. It soon became apparent, however, that it would be advisable to provide accommodation also for their wives and families. As the number of students was below the maximum which could be accommodated, this was made possible by the taking over by the School of the Hostel referred to above. In the future, the extension of Block C, referred to in "Preparation of Accommodation", paragraph (e), will be required as well for this purpose.

Settlers' wives being at the School, instruction for them, on a voluntary basis, was provided in farming subjects which would be of particular use to them, and in Swahili and in tropical health and hygiene, and they were also at liberty to attend any part of the full course for their husbands.

Many social contacts were made possible for new settlers at week-ends in the early part of the course with the valuable assistance of the E.A.W.L.

The full course for men was designed to cover the syllabus of the one year Agricultural Certificate Course of the School. Instruction was given both practically and theoretically under these main heads:—

The Soil.

Crop Husbandry.

Animal Husbandry—Dairy Herd, Pigs, Poultry, Sheep.

Grassland.

Farm Engineering.

Farm Management and Economics.

The African as an Employee.

Farming Legislation.

Dairy Technology.

Short Courses

A number of special students were given short courses of training in various farming subjects.

Extension Work

Towards the end of the year it was agreed to hold farmers' days at the School, but none will be held until 1947.

The Veterinary Officer of the School was responsible for district veterinary work on the northern part of the Nakuru district.

Numerous visitors came to the School and were shown the farm.

Farm

Acreages.—The approximate present allocation of acreage is as under:—

Arable rotation—								<i>Acres</i>
Plough	..	..	..	..	..	..	..	270
Temporary grass	..	..	..	..	..	..	..	210
							—	480
*Permanent grass and undeveloped land and trees	..	..	..	..	..	..	..	150
Lucerne	..	..	..	..	..	..	..	10
Pyrethrum—grass rotation	..	..	..	..	..	..	..	20
Uncultivable and grazing	..	..	..	..	..	..	..	50
School, houses and grounds	..	..	..	..	..	..	..	50
							—	
Total acreage of estate	..	..	..	..	..	..	..	800

* 35 acres undeveloped.

The Arable Rotation.—There are two eight-course rotations.

The fields to be used in these, which were described in the 1945 Annual Report, all came into being in 1946, but four of these are not yet fully demarcated as they are under grass which has not yet been ploughed up. The system of rotation and manuring as described in 1945 remains unchanged except that it is intended in the future to eliminate the vetch course and to grow instead peas in one of the maize courses.

Pyrethrum Rotation.—New land is now ready for this and will be planted in 1947. Half of the old pyrethrum acreage reverted to grass; the other half will revert to grass in 1948. All the old pyrethrum land will eventually come in the arable rotation; the new pyrethrum land being steep at the top of the farm.

Products Sold.—As in 1945, with the addition of young bullocks and veal calves, widders and wool. Preparations were being made at the end of the year for cheese production.

Cropping in 1946.—Approximately 270 acres were under the plough, representing nine fields of approximately 30 acres each.

First Eight-course Rotation.

Field 1—Temporary ley. Experimental sowings.

Field 2—Temporary ley.

Field 3—Temporary ley.

Field 4—Maize for human, cattle and pig food, underplanted with Star grass for temporary ley in 1947.

Field 5—Vetch for hay and grazing.

Field 6—Barley for pigs.

Field 7—Oats for hay for cattle and grain for cattle.

Field 8—Barley for pigs, 5 acres; rye for thatch, 10 acres; flax, 7 acres; potatoes, 3.5 acres; mangolds, 3 acres; linseed, 1.5 acres.

Second Eight-course Rotation.

Field 9—Wheat.

Field 10—Maize for human, cattle and pig food.

Field 11—Maize for human, cattle and pig food and silage.

Field 12—Wheat.

Field 13—Reverted grassland counting as the temporary ley pasture of the second rotation.

Field 14—Reverted grassland counting as the temporary ley pasture of the second rotation.

Field 15—Reverted grassland counting as the temporary ley pasture of the second rotation.

Field 16—Reverted grassland counting as the temporary ley pasture of the second rotation.

It will be seen that in the second rotation half the fields are under the plough and half under grass, and in the first rotation that proportion of grass to ploughed land will have been attained in 1947.

Production of Major Crops.

Wheat.—530 bags; 117A 10 bags per acre; 291J 10 bags per acre; *Regent* 7 bags per acre.

Barley.—158 bags; 4.5 bags per acre.

Oats.—152 bags; 10 bags per acre.

Maize.—900 bags; 15 bags per acre.

Pyrethrum.—586 lb. per acre.

Linseed.—20 bags.

Flax.—2 tons, fibre and tow.

Oat and Vetch Hay.—45 tons; 3 tons per acre.

Maize Silage.—125 tons; 8 tons per acre.

The Grade Dairy Herd.—In the grade Ayrshire and Friesian herd the number of milch cows increased from 50 at the beginning of the year to 55 at the end. There were 49 heifers not yet calved down and 10 heifers calved by the end of the year. The bulls in these herds were the same as in 1945. Artificial insemination was not introduced as it was impossible to find proven sires for use by means of it.

These herds were culled, home-bred heifers came into milk. The average number of cows in milk was 41.

Daily production averages for these two herds were:—

January, 18.5 lb.
 February, 18.4 lb.
 March, 18.1 lb.
 April, 17.8 lb.
 May, 19.8 lb.
 June, 18.5 lb.
 July, 18.1 lb.
 August, 17.5 lb.
 September, 19.1 lb.
 October, 21.3 lb.
 November, 20 lb.
 December, 20.3 lb.

The average lactation was 583.5 gallons.

28,709 gallons of milk were produced in the year at an approximate cost of 45 cents a gallon. The average butterfat content was approximately 4 per cent. Whole milk, butter and butterfat were sold. Cheese-making was commenced towards the end of the year. Veal calves and young bullocks were sold.

The Boran Herd.—Ten Boran heifers inseminated by an Ayrshire bull were obtained from the Konza Holding Ground as the foundation of a separate herd, which will be graded up and run on the Movable Bail system.

Pigs.—Ninety-nine baconers were sold. The demand for stock for breeding purposes increased and several boars and gilts were sold for breeding. Some animals of our breeding were registered in the herd book.

Extra buildings were being constructed at the end of the year for the reception of pedigree Large White stock to be imported from the United Kingdom by the Pig Industry Board.

The improvement in time of fattening to bacon weight was maintained.

Poultry.—The breeding flocks of Rhode Island Reds and White Leghorns were enlarged. Egg production in 1947 should be greatly increased.

Sheep.—Two new Romney Marsh rams were bought, one of which died. The other proved satisfactory. A number of wedders was sold during the year.

Horses.—Three geldings were bought and will be used for instruction in horse management.

Buildings.—The new milking shed and dairy were almost completed. The new implement shed was almost completed. The first stage in the enlargement of African accommodation was completed. The silage pits were walled and roofed. The new farrowing pens and boar house were completed. The new fattening pens for pigs were begun. The new maize cribs were completed.

Labour.—The supply improved towards the end of the year. Improved housing for permanent men and their families was increased. The number of permanent men with families increased. The full ration scale and the bonus system introduced in 1945 were continued. Each family is allowed $\frac{1}{4}$ acre of land for a garden. In 1947 it is intended to erect a school and hall in the farm camp.

Development.—Sixty more acres were stumped, cleared and terraced and brought under cultivation as fields 9 and 12. This completed the second arable rotation.

There remains only 35 acres of the estate to be developed; this area will be used for pyrethrum, grass between pyrethrum courses, and trees.

Trees.—Shelter and shade belts were added to in the arable rotation. Fuel plantations were increased. A tree nursery was made.

Manuring.—The programme as outlined in the 1945 Annual Report remained unchanged. The production of farmyard manure was increased. Top dressings of guano and bonemeal, half and half, at the rate of 120 lb. per acre, noticeably increased the yield of maize and oats.

Vegetables.—The two gardens suffered from lack of water for irrigation, but it is anticipated that this will be rectified in 1947 now that the borehole is in use.

Fruit.—It was not possible to establish fruit plantations this year, but it is hoped to establish small areas under fruit for demonstration purposes in 1947.

Machinery.—There is now a fairly wide selection of farm machinery and implements available for tuition. Major additions in 1946 included:—

A Combine-harvester.

A five-furrow tractor disc plough.

A T.D. 6 crawler tractor.

A silage chaffer.

A cultivating attachment for a Farmall tractor.

Grass Ley Establishment.—The method was tried of establishing leys under temporary cover, which would not be left in until grain maturity but which would be used only for early grazing attraction on the ley. The 1947 growth of the leys may give some indication of the success of this treatment.

Fencing.—Fencing was added to as required for temporary leys.

Cost Accounts and Records.—Cost accounts and records as described in the 1945 Annual Report were kept.

Revenue.—Gross earnings were within a few pounds of £3,000. The decrease in comparison with 1945 is accounted for by the fact that 140 acres of rented land cropped with wheat in 1944, the proceeds of which came in 1945 revenue, had been given up. The pyrethrum acreage was also slightly reduced. On the other hand, the returns per acre for wheat and maize were greatly increased and returns from the sale of dairy products increased considerably also.

J. E. P. BOOTH,
Principal.

ANNUAL REPORT OF THE BUKURA SCHOOL OF AGRICULTURE, 1946

SECTION I

Staff

European.—Mr. E. L. Bradford, Assistant Agricultural Officer, proceeded on home leave July 9th and returned October 28th. Mr. G. M. Lavers took over during that period.

African.—Teachers Aloys Okello and Ezekiel Kangu were engaged in January, replacing W. H. Khanani, who resigned at the end of 1945. There is one clerk, one field instructor, one carpentry instructor and one mason instructor.

Labour.—Average figures for the year were as follows:—

Agricultural Department.—12 routine labourers (e.g. post boy, engine boy, guards, herds, etc.), 17 semi-permanent labourers for building construction, farm maintenance and development.

Local Native Council.—2 nursery boys, 1 spinning and weaving instructress, 5 temporary for construction of new Spinning and Weaving School.

Agricultural Training

Senior Apprentices.—31, of whom 7 were dismissed or discharged as unsuitable for training.

Junior Apprentices.—30, of whom one was sent for only one year's refresher course. One left as he was mental and one was dismissed.

Teacher Trainees.—Three, for one year's agricultural training to fit them for teaching of agriculture on proper lines in schools.

Having two teachers this year, the work was greatly facilitated: one took the juniors and one the seniors, with two evenings a week each for apprentices' evening classes in English and Arithmetic. The divorcing of these two subjects from the main agriculture, animal husbandry and botany subjects has enabled the curriculum to be completed within the two years' course—which had not been possible in previous years—and to extend the course to include such subjects as Agricultural Legislation, Elementary Economics and Soil Conservation.

Graham and Hammond's publication "Elementary Live Stock and Pasture Management" is proving invaluable as a textbook in Animal Husbandry and, with one copy issued to each mixed farm, there is no excuse for improper supervision and feeding of stock on the holdings.

During the year many lessons were revised and brought more up to date.

More expensive and better bound note books were issued this year, as the cheap paper covered exercise books which were formerly issued wear out before they are full and such notes will never form a permanent record of the apprentices, neither will they be capable of referring to such notes in the years to come.

Although many apprentices coming up for training are still standards II and III, quite a number have better educational qualifications, whilst four post-primary apprentices are being accepted annually. This gradual raising of the standard of education facilitates the theoretical instruction and will gradually result in a better and more intelligent type of trained instructor. Even this year under review it has been noticeable that the leavening of higher standard apprentices has stimulated the more backward apprentices to greater mental effort, and those who were passed out at the end of 1946 were probably the best batch of potential instructors to leave Bukura. The technical training includes:—

- (a) Rough farm carpentry, such as the making of yokes, skeys, sledges, peg-toothed harrows, milking sheds, doors, windows, beds, chairs and roofing principles, soldering of pots and pans and shaping metal.

(b) Mason work, such as brick making and burning, bricklaying, pointing, etc.

(c) Soil Conservation, laying out of contours at the proper vertical intervals, mensuration and elementary instruction in the use of the quick-set level.

As a result of such training apprentices are now capable of constructing all farm buildings on their respective holdings and, in fact, carrying out all duties connected with mixed farming. This should save them many a fundi's fees in the years to come.

Health of Pupils.—Bukura is not a healthy place, especially for apprentices coming from Kisii and Kericho. There is much malaria and "Bukura Lumbago". By dusting the swamp on the west boundary with Paris Green and lime and the flitting of all quarters with D.D.T. the incidence of malaria was moderately reduced this year. The enforcement of a balanced diet to include maize sorghum or wimbi, groundnuts or soya beans and roots may also have had a bearing on health.

Publications

"Bukura Native Agricultural School." (*E.A. Agricultural Journal* of January, 1946. Outlining the work at Bukura, the method of training of apprentices and their social life.)

"African Mixed Farming Economics as Applied to Bukura." (*E.A. Agricultural Journal* of October, 1946. Dealing with family diet in its relationship to crop rotations and mixed farming on small acreages, the optimum acreage required per average family's food requirements, the size of holding required to give an average family a sufficient annual income.)

Publicity

A Farmers' Day was held on 11th June and between 500–600 people, chiefs and elders attended. Visitors in small parties were conducted round the mixed farms, the School, the Spinning and Weaving School, etc., by senior apprentices (who had been previously instructed by lectures and notes in details of publicity). The whole system of mixed farming in vogue here was explained: its actual simplicity, its saving in acreage, its steady improvement of soil fertility, etc.

Visitors were fed the varied and balanced diet of the apprentices and were given soya bean coffee. They appeared to be well impressed with everything and many inquiries were received—especially for soya bean seed.

Visits

The following distinguished visitors paid a visit to Bukura during the year:—

The Director of Education; the Director of Women's Training; the Medical Officer of Health, Nyanza; the Hon. Provincial Commissioner. The District Commissioner came in January to investigate the possibilities of starting a Women's Teacher Training School here.

The District Commissioner, South Kavirondo, and Tribunal elders came in February to see mixed farming methods, etc. H.E. the Governor, his Private Secretary, the Hon. Provincial Commissioner, the District Commissioner, Senior Agricultural Officer on an official visit in June.

Various schools have sent parties of pupils.

Several Chiefs and their parties have been shown over Bukura during the year.

Mr. N. Humphrey, Senior Agricultural Officer, paid several visits of an agricultural and anthropological nature.

Captain Kingston Davies, of the Military Information Bureau, filmed the activities of Bukura last year. It is a pity that still no copy of this film has been obtained by the Department for publicity purposes.

Social Welfare

Spinning and Weaving.—An average of 34 pupils, including the wives of teacher trainees, attended. With this steady expansion, the temporary quarters loaned for this purpose were found to be inadequate and funds from the Local Native Council were made available for the construction of a proper school to accommodate 40 pupils. The building was completed by the end of the year except for doors and windows.

Scouts

The School maintains a troop of scouts and the apprentices showed a fairly keen interest. The annual Scout Rally was attended at Butere.

Sport

The football team this year was merely average, but keenness was not lacking.

Bukura apprentices acquitted themselves so well at the district athletic sports that six were sent to Kisumu, of whom three were selected to represent the Province and went to Nairobi with the Provincial team.

Arts and Crafts Exhibition, Kisumu

Two Certificates of Merit for spinning and weaving were obtained at the Provincial exhibition.

Developments

Buildings.—As previously stated, the new spinning and weaving school was built in burnt brick and thatched. Doors and windows only remain to complete the work.

A three-unit rondavel in burnt brick was completed for the clerk. Another similar building was completed on No. 2 mixed farm, whilst another on No. 16 was started and by the end of the year the walls were finished.

The implement shed in burnt brick piers was thatched, but funds would not permit the completion of the walls with strong maize crib wire—neither was this item available in Kenya. All apprentices' quarters, kitchens and lavatories were whitewashed.

The new school was completed during the first quarter as far as materials permitted and instruction was started therein. Paint, guttering, as well as desks for the laboratory section, are still required to complete the job.

Instructional Farms.—No. 18 is being developed into a 12-acre mixed farm, having a compound and living quarters, a $\frac{3}{4}$ acre timber plot, 3 acres of arable, 3 acres of ley and 5 acres of permanent pasture. This holding is being developed on these lines because many African visitors state that they have much more land than the average 6-acre mixed farm in operation here and many more cattle than can be accommodated on 5 or 6 acre farms. The object will also be to obtain statistical data on profits, man-hours required to cope with this acreage, etc., etc.

Hedges were planted a year ahead for a new instructional farm to be developed this year, and a road of access prepared. A $\frac{3}{4}$ acre plot of timber was planted up and 2 acres put down to Kikuyu grass ley. This farm will take the place of No. 1 when the latter is absorbed into the co-operative group of farms.

SECTION II—INVESTIGATIONAL

Arboretum

All species planted are now tabbed. No new species were planted, but infilling was undertaken.

Plant Observational Trials

East African Sword Bean (*Canavalia ensiformis*) is proving an ideal cover and green manure crop and compares favourably with farmyard manure. An added advantage as a green manure is its prolific production of seed.

Local Compositæ (*Helianthus* sp.).—When ploughing up the new arable which had been rested for six years it was noticed that in the area dominated with *compositæ*, couch grass had been completely ousted, that the soil was more friable and of crumb texture. This, therefore, may be the answer for couch infested land, a 4-year rotation to a *compositæ* green manure. As a trial, two acres of land heavily infested with couch is being ploughed up next year and will be planted to *compositæ* and left for yearly observation.

Maltese Clover was tried out as a possible addition to hay crops. It germinated poorly and was killed out by excessive rain.

Swedes and Mangolds were tried as a supplementary succulence for stock. Germination was good, but a wilt disease destroyed the crop when only 3 in. high. Most root crops in this area, with the exception of sweet potato, seem to suffer from the excessive rainfall.

Osage Orange Hedge.—Some seed was received from America through Kima Mission. It failed to germinate.

Legumes.—Soya beans and groundnuts have been the only legumes until recently which justified planting. Beans, cowpeas and field peas merely produced their own seed requirements, and this has resulted in a diet problem. Pigeon pea has now been tried over a period of two years, has stood up to local climatic conditions and produced well, with the result that it has now been included in the crop rotation. Its benefit to the soil is another asset in mixed farming.

A tall-growing cowpea, locally known as *Ngoch Nyaluo*, is also to be tried.

Pasture and Hay Grasses.—Star and Kikuyu grasses are still the standard pastures here pending further investigations. Grass plots of the following varieties have been put down for observational purposes:—

Molasses Grass (*Melinis minutiflora*).

Makarikariensis.

Paspalum sp.

It is too early to comment on them. The following hays have been planted in the Instructional farms:—

Teff (*Eragrostis abyssinica*).—Two years' trial.

Nzoia Rhodes Grass (*Chloris gayana*).—Two years' trial.

Provence Lucerne.—Two years' trial.

Bromus marginatus.—One year's trial.

Teff.—If sown midrains in weed-free land two cuttings can be obtained before it is choked by weeds. It is probable from observations made that much of the second crop is from reseeding prior to the first cutting. At Bukura, where the rains tend to continue through from March to November and hay-making is limited to 4-5 day dry spells, Teff has its advantages in that it is quickly cured. It is very palatable and relished by stock.

Rhodes Gress.—Is more bulky than Teff and also requires weed-free land to establish itself properly. When established, it can compete more favourably with weed growth than Teff and two cuttings are obtained. It takes longer to cure than Teff.

Provence Lucerne.—Required so much weeding to keep it established that it has now been discarded.

Bromus Marginatus.—Was a failure.

Haymaking.—Hay stacks in the open, on staddles, was proved a failure last year through excessive rainfall and termites. This year, part of the milking sheds on the mixed farms was converted into hay barns. This method is proving much more successful. During a lull in the rains the hay can be cut and dried for one or two days, brought to the barns and spread outside to complete curing; if rain threatens it can be quickly thrown into the barn and brought out again with the next spell of sunshine.

Hedges.—The aim of the trials here is to find a suitable, easily established, quick growing, stock proof hedge easily trimmed, and the following varieties are on trial with that end in view—a brief interim commentary is given on each:—

- (a) *Duranta plumieri*.—Quick growing, slightly thorny; handsome, but tends to wilt during the dry weather. The slightest gap in the hedge is sufficient for the stock to break through, as the thorns, although up to one inch in length, appear to be brittle on the cow's hide. To enhance its stock-proof quality the hedge should not be side trimmed, thus giving it greater width. Easily kept in trim by a bush knife. Strikes well from cuttings, but a month or so after planting the cuttings tend to die off (an 80 per cent strike will be reduced to 30 per cent, so cuttings should be planted four or five inches apart). Poor germination from seed, even when boiled or lightly roasted.
- (b) *Kei Apple*.—Essential to plant in nursery and leave for twelve months (younger seedlings are too easily damaged). Slow growing, takes three to four years from transplanting to become fully established. Handsome, strong thorns, stock-proof, easily trimmed.
- (c) *Euphorbia sp.*—Planted from cuttings. Attains a height of 4 to 5 ft. in two years. Fragile fence and dangerous to cattle on account of the caustic properties of the sap, causing blindness in cattle. If left to grow 5 to 6 ft. would probably be stock-proof, as cattle fear its caustic properties. Easy, though rather dangerous to trim, but, having little side-growth, only periodical topping is required.
- (d) *Giant Solanum sp.* (*Lirovo*, *Luluhiya*).—Seeded in banana pots, the seed first boiled or lightly roasted. Used extensively by Wameru as a hedge and considered by them capable of keeping out elephants when allowed to grow to 15 ft. When the side branches are intertwined it makes a good fence. Stock-proof; growth 5 to 6 ft. in twelve months. Not a handsome hedge.
- (e) *Cassia grandifolia*.—Planted in banana pots, as it does not transplant well. Quick germination; quick growth, 4 ft. in twelve months. Is transplanted 2 ft. apart. If well pruned in the first year becomes bushy. Easily trimmed; no thorns. Hedge tends to form gaps. Handsome foliage and flowers. Doubtfully stock-proof.
- (f) *Mauritius Thorn* (*Caesalpinia sepiaria*).—Seeded at stake, the seed first boiled or roasted. Germination good. Slow growth the first year, but rapid thereafter. Must be kept well trimmed otherwise it gets out of

hand. Constant trimming, however, causes it to die out after seven years or so. Very thorny, tricky to trim. Very stock-proof.

(g) *Dovyalis* sp. (*Sinduli*).—Strikes more readily from cuttings than *Duranta*. Thick third and fourth year wood will strike, thus expediting its establishment. Has edible fruit, leaves reddish tinge, fairly handsome, stools well. Promising, but too early to state whether stock-proof or whether easily trimmed.

(h) "*Lutsoi*" (*a local shrub*).—Long thorns, deep green foliage, resembles Kei Apple but appears to be quick growing. Planted from seedlings; does not strike from cuttings. Transplanting losses negligible.

Of the varieties mentioned above, Kei Apple is probably first choice to date as an effective and handsome permanent hedge. It is, however, much too slow a grower. Second choice is Giant *Solanum* for its effectiveness and quick-growing habits, but it is not a pleasing hedge.

A trial was started this year to plant a row each of Kei Apple and Giant *Solanum* (rows 2 ft. apart), the object being to establish the hedge quickly with the Giant *Solanum* whilst the Kei Apple is slowly establishing itself. The *Solanum* will eventually be cut out.

Experimental

Ten-year Phosphatic Trials.—Arranged in randomized 1/40th acre plots of five treatments, viz.:—

1. Control.
2. Silicophosphate, 100 lb. per acre.
3. Silicophosphate, 200 lb. per acre.
4. Rock Phosphate, 200 lb. per acre.
5. Rock Phosphate, 400 lb. per acre.

Replicated six times with guard rows to prevent border effect. The fertilizer was applied direct to the seed hole by teaspoon.

The first crop (maize) was harvested and the yield figures sent to the Senior Agricultural Chemist.

As phosphates are of doubtful value on poor soils, some arrangement regarding periodical organic manuring of the land needs to be incorporated in the experiment before a true appreciation of results can be obtained. A cursory glance at the first season's yield figures shown no significance between control and the treatments.

Rice Variety Trials.—Alternate rows of five varieties were planted and replicated six times each in two adjacent bunds, making twelve replications in all.

The yield figures were submitted to the Statistician for analysis.

The mean yields of the five varieties calculated from the twelve rows are given in order of magnitude:—

- Bungalo, 65.2 oz.
- Maji maji, 54.6 oz.
- Ambarekore, 43.1 oz.
- Sindano, 33.0 oz.
- Mbuyu, 24.6 oz.

Any two means differing by 9.0 oz. or more were regarded as significant.

Rice Blast.—Conjointly with the above experiment counts of blast were made row by row and variety by variety.

The plots on the whole were not significantly different but the interactions between plots and varieties were very significant; both these results were not quite

in line with what might be expected. The varieties, judged as a whole, are significantly different among themselves.

The means calculated on 12 observations are given below in order of magnitude ignoring the fact that the interaction is significant. The factor in this case equals 22.9, also ignoring the significance of the interaction.

Maji maji, 92.3.

Bungalo, 91.8.

Sindano, 83.8.

Ambarekore, 82.3.

Mbuyu, 34.9.

The first four varieties were significantly higher than Mbuyu.

Rice Blast in Relation to Green Manuring.—Six varieties were each planted in four plots, two of which were green manured and two controls. As the replications were insufficient the results were not sent to the Statistician.

It was, however, interesting to note that blast tended in most cases to increase with green manuring and that this could not by any means be considered a method of controlling the disease.

Variations from the Mean

Variety	Green Manure				Control		
Senna	..	..	..	..	+39	..	-39
Faya	..	..	..	..	+72	..	-72
Mbuyu	..	..	..	..	+49	..	-49
Bungalo	..	..	..	..	+74	..	-74
Sindano	..	..	..	..	-49	..	+49
Ambarekore	..	..	..	..	- 8	..	+ 8

Sociological Economics in Relation to Land Units.—Over a period of years data has gradually been obtained from the mixed farms concerning this important aspect and an article appeared in the October Agricultural Journal on the subject. Only a summary of the findings are therefore given hereunder:—

- (i) The maximum unit of land that can be economically worked by an average family (5.69) under intensive farming conditions is found to be 6 to 7 acres, half of which is under arable and half under ley. To manage this acreage properly the family would have to perform $12\frac{1}{2}$ work-hours daily (i.e. the man full time and wife and children part time).
- (ii) The minimum stock and arable requirements to produce an adequate diet for an average family (2,500 calories) is found to be a 5-acre holding, half ley, half arable, carrying two cows, one ox and two current year calves.
- (iii) The optimum acreage required to supply a family with a reasonable standard of living (Sh. 400 per annum) is found to be 4 acres of ley, 4 of arable, 6 acres of permanent natural pasture, total 14 acres; or alternatively 3 acres of permanent pasture if planted to good grasses, making a total of 11 acres. This ley and pasture would suffice six working oxen, four cows and progeny (say three two-year olds, four yearlings and three calves. The two-year olds would have to be sold off at each year's end).
- (iv) The ratio of stock to arable on poor soils has been computed from trials of five beasts (giving 12 tons FYM per annum) to 3 acres of arable to keep it in good fettle with a manurial rotation of a 3-4 year cycle.

SECTION III

Instructional Mixed Farms

There are eighteen developed mixed farms varying in size from $1\frac{1}{2}$, $2\frac{1}{2}$, 5, 6, 7 to 12 acres, thus allowing scope for a variety of statistics to be obtained.

The system of training apprentices and accommodating them in "families" on these mixed farms gives them the soundest and most comprehensive form of instruction possible and slackers are easily spotted. Each farm is self-contained with "family" quarters, kitchens, lavatories, stores, milking sheds, calf pens, stock, leys and arable, and the "families" are fed from the produce produced off their own farm. The apprentices remain on that farm as juniors and latterly as seniors for the whole two years' course, so their abilities are easily determined. No manual assistance whatever is given them, they have to perform every operation thereon. They do, however, receive all the advice they require and adequate supervision.

They see and undertake on their own holdings much work of a trial nature, e.g. hay varieties, hedge varieties, haymaking improvisations, plant trials in their second year.

Co-operative Farms

This block of farms on a contour is now beginning to take shape, and they are beginning to work along the lines for which they were devised; viz. co-operative assistance amongst the families in the group organization, e.g. communal ploughing and use of work oxen generally, the collective herding of stock, care of paddock hedges, etc., harvesting, synchronized strip crop rotations along the contours—which method will eventually extend to the rotation of pasture and arable. This permits of ploughing on the contour from end to end of the block.

As a result of the general improvement in yields and facility of work organization there has been much more co-operation this year and even the women have pulled their weight. A new family came in at the end of the year (an ex-apprentice who had been trained on this co-operative farm) and another family is seeking admission. Hedges have now been planted on three sides of the farm, two night bomas built and part of the old pasture ploughed up and planted to Kikuyu Star grass ley.

It is hoped next year to start collecting statistical information on yields, cash crops, stock requirements, etc., and to investigate problems always inherent in a new venture.

Establishment of Pastures

Mixed Star and Kikuyu grasses are still the best so far determined for this area, although Nzoia Rhodes grass promises well for a short-term ley.

The interplanting of a standing crop (such as maize), after its first weeding, to Cynodons, etc., proving successful providing a further weeding is given the grasses when the standing crop is mature. It takes from four to six months for the rhizomes to extend to the base of the maize crop, by which time the maize is due for harvest. A slashing of weeds two months later, to give the decumbent grasses light, should then be sufficient and light grazing can commence in a further three months time.

Arable/Pasture Rotations

This has been a problem on smallholdings owing to the smallness of the acreage. If the pasture is ploughed up first the stock will be short of grazing. If arable is first planted to grass then the holder will be short of food.

In trials worked out this year the prospect of a solution appears possible by:—

- (a) Dividing the holding into eleven contours, five to arable, five to ley and one for rotation.
- (b) Planting the standing crop to grasses in the short rains and ploughing up the equivalent pasture in the ensuing long rains.

By this means the holder obtains his crop from the area rotated to grass in the Short Rains and the stock have not yet been deprived of grazing. In the long rains the stock lose part of their grazing area, but the new ley has produced a mediocre hay crop from the slashing of weeds (*see above*) and the stock will be permitted a light grazing on this area from time to time.

SECTION IV

Meteorological

The long rains were late in arriving, but the grass rains, which broke in the beginning of March, continued for some ten days and permitted of planting. The main rains broke on the 7th April and continued persistently to the end of September; in fact, the long and short rains merged into one. This always augurs ill for the short rain plantings as the soil has had no opportunity of aerating or warming up, and seed planted in cold, waterlogged, airless soil lacks health and vigour.

The short rain plantings were consequently a failure, the long rain crops produced good yields but showed a heavier incidence of disease.

	<i>Rainfall, 1946</i>				<i>Average for 23 years</i>	
January	..	..	..	.29	..	1.60
February	..	..	..	—	..	3.02
March	..	..	..	5.06	..	5.93
April	..	..	..	11.28	..	9.14
May	..	..	..	9.88	..	9.44
June	..	..	..	10.71	..	6.35
July	..	..	..	7.34	..	5.15
August	..	..	..	12.96	..	7.51
September	..	..	..	9.40	..	6.20
October	..	..	..	2.10	..	4.74
November	..	..	..	6.41	..	4.47
December	..	..	..	5.46	..	3.39
			Total	80.89	..	66.94

14 lb. above average.

E. L. BRADFORD,
Assistant Agricultural Officer.

ANNUAL REPORT OF THE OFFICER IN CHARGE, DRIED VEGETABLE PROJECT, 1946

Staff

European.—Headquarters: 4; Karatina Division: 10 (Factory 5, Compound 1, Sagana Falls Hydro-Electric Plant: 1, Field: 3); total: 14.

Asian.—Headquarters: 2, Karatina Division: 20 (Factory 16, Sagana Falls Hydro-Electric Plant: 4); total: 22.

African.—Headquarters: 1; Karatina Division: 36 (Compound 31, Sagana Falls Hydro-Electric Plant: 5); Kerugoya Division: 18 (Headquarters and Care-taking); total: 55.

Italian.—Nil.

All European and Asian staff were given one month's salary in lieu of notice on the 31st December, 1946, and only a minimum staff of Africans has been kept on for security and essential services.

Mileage

Miles (Government vehicles) (approx.)	..	..	123,000
Miles (private vehicles)	..	..	16,862
Grand Total			139,862 miles

Rainfall

			Jan.-Sept.	Oct.-Dec.		Total
			L.R. 1946	S.R. 1946		
Chehe	..	..	46.21	..	17.12	63.33
Karatina	..	..	37.81	..	16.36	54.17
Werumuhia	..	..	47.38	..	17.13	64.51
(Oct.-Nov. only) (to 30.11.46)						

Remarks.—

Long Rains.—Started early April—rains lighter than usual. The heaviest recorded fall occurred in May—5.04 in.—followed by 2.05 in. the next day. Very little rain in June and July—August 2.20 in.

Short Rains.—Started in August and finished on 15th November. Crops planted in August did well but those planted later suffered from dry conditions.

Field Production

SHORT RAINS, 1945

IRRIGATION. PLANTED AUGUST—NOVEMBER, 1945. CARROTS

205

IRRIGATION	Area	November	December	January	February	Total Yield	Yield
	<i>Acres</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb. per acre</i>
Ihwagi Irrigation	79-00	—	—	602,943	131,367	734,310	9,295
Ihwagi Nursery	4-50	—	—	31,812	31,404	63,216	14,048
Karatina Nursery	2-10	—	—	7,609	9,780	17,389	8,280
Karindundu Nursery	2-10	—	—	8,024	4,210	12,234	5,825
Kirigo	2-82	—	7,825	1,539	8,599	17,963	6,369
Karindundu Irrigation	36-00	—	—	192,583	77,994	270,577	7,516
Ndurumoini	5-40	—	—	16,396	21,418	37,814	7,003
Kururu	23-50	21,676	16,738	33,739	59,046	131,199	5,583
Mukongoro	13-00	—	20,435	59,146	—	79,581	6,121
Gatundu	37-47	14,475	66,802	27,934	99,964	209,175	5,582
Turi	36-83	7,417	34,831	39,871	123,771	205,890	5,590
Kangosho	2-81	—	—	38,875	—	38,875	13,830
Gacharagu	9-97	—	57,800	48,235	12,632	118,667	11,902
Weru Muhia	4-12	—	10,176	22,519	—	32,695	7,935
Thakumi Irrigation	6-85	—	10,763	19,918	12,474	43,155	6,300
Sagana Falls	22-00	—	—	31,617	73,660	105,217	7,014
TOTAL	281-47	43,568	225,370	1,182,760	686,259	2,117,957	7,524

POTATOES YIELD CROP PLANTED AUGUST TO NOVEMBER, 1945

NAME	Area	January	February	March	April	Total Yield	Yield Acre	Bags
		Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Per acre
DRY LAND :—								
Chehe	115.00	65,271	35,140	20,240	107,815	228,466	1,986.66	11.03
Karatina Experimental Plot	3.39	8,591	1,851	—	—	10,442	3,080.20	17.11
Gachuku	1.08	1,827	—	—	—	1,827	1,691.66	9.39
Gathugu	1.06	912	—	—	—	912	860.37	4.78
Kangocho	.66	2,388	—	—	—	2,388	3,618.18	20.10
Gaikuyu	2.00	3,585	—	—	—	3,585	1,792.50	9.96
SWAMP :—								
Kinyariti	14.08	126,806	—	1,671	—	128,477	9,124.78	50.69
Gathanji	11.00	39,396	9,525	494	61	49,476	4,497.81	24.98
Thakumi	11.50	3,512	7,642	2,078	—	13,232	1,150.60	6.33
IRRIGATION :—								
Gatundu	34.50	27,349	26,959	51,255	34,761	140,324	4,067.36	22.59
	194.27	279,637	81,117	75,738	142,637	579,129	2,981.05	16.56

1. The above plantings were not sprayed with Bordeaux.

2. The Swamps suffered from bacterial wilt.

IRRIGATION POTATOES YIELDS. CROP PLANTED JANUARY AND FEBRUARY, 1945 AND 1946

	Area	Feb- ruary	March	April	May	June	Total Yield	Yield per acre	Bags per acre	Remarks
		Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.		
Ihwagi Irrigation	79-00	—	—	32,501	384,623	237,134	654,351	8,282-92	46-01	
Ihwagi Irrigation	4-50	—	—	—	24,212	25,148	49,360	10,978-68	60-99	
Karatina N.	2-10	—	—	—	21,021	1,430	22,451	10,690-95	59-38	
Kirigo N.	2-82	—	—	—	7,737	19,087	26,824	19,512-05	52-84	
Karundundu N.	2-10	—	—	—	13,352	11,213	24,545	11,688-09	64-92	
Karundundu Irrigation	6-00	—	—	18,279	91,386	179,770	289,435	8,039-86	44-66	
Ndurumoini	3-40	—	—	—	13,334	29,203	42,537	7,877-22	43-76	
Kururu	23-50	2,824	15,657	14,826	19,878	123,636	176,821	7,524-29	41-80	
Mukongoro	13-00	—	—	—	87,707	—	87,707	6,746-57	37-48	
Gatundu A.	10-96	—	—	—	100,294	—	100,294	9,150-91	50-83	
Gatundu B.	12-42	—	—	—	—	55,770	55,770	4,490-33	24-94	Late planting attacked by Ladybirds.
Turi	36-83	—	—	31,346	54,899	87,004	173,249	4,725-71	26-25	
Gacharage	9-97	—	—	11,464	7,752	36,889	56,105	5,627-38	31-26	
Kangocho	2-81	—	—	—	10,189	12,562	22,751	8,096-44	44-98	
Waru Muhia	4-12	—	—	—	21,695	20,182	41,877	10,164-56	36-47	
Thakumi	6-85	—	—	—	12,781	4,651	17,432	2,544-81	14-13	Due to lack of water.
Sagana Falls	22-00	—	—	14,972	27,625	42,216	84,213	3,327-86	21-26	Due to lack of water.
Gaikuyu N.	3-49	—	—	—	23,733	33,890	57,623	16,510-87	91-72	
Itoga N.	3-07	—	—	—	—	48,466	48,466	12,529-64	69-60	
Karika N.	3-34	—	—	—	39,005	—	39,005	11,678-14	64-87	
	284-28	2,824	15,657	123,778	960,608	968,251	2,070,813	7,284-21	40-46	

1. The above plantings were sprayed with 1 per cent Bordeaux every ten to fourteen days.
2. Due to better seed there was not much bacterial wilt.

Issue of Seed and Seedlings.—The following seed was issued from the Central Store, Karatina, to the Field during periods January–July (Long Rains) and August–December (Short Rains).

JANUARY–JULY						
				<i>Cabbage</i>		<i>Carrot</i>
				<i>lb.</i>		<i>lb.</i>
Kerugoya	..	..	..	—	..	388
Karatina	..	..	..	1,208	..	1,708
AUGUST–DECEMBER						
				<i>lb.</i>		<i>lb.</i>
Karatina	..	..	..	—	..	—
Kerugoya	..	..	..	—	..	—
Total	..	..	..	1,208	..	2,096

Remarks.—Turi carrot seed (Chantenay) was used to a large extent and it was found to be inclined to “bolt” especially during dry spells and in poor soil; it cannot be compared with imported seed.

Co-operative Irrigations—Karatina Sub-Division.—The following analyses of carrot yields for 1943, 1944, 1945 and 1946 are set out below for comparison. Two crops of carrots and two of potatoes or cabbage were harvested in 1946 making a total of four crops of vegetables off the same land in one year:—

<i>Year.</i>	<i>Total growers</i>	<i>Acres</i>	<i>Yield</i>	<i>Yield per</i>	<i>Average</i>	
		<i>Carrot</i>		<i>acre</i>	<i>per grower</i>	
			<i>lb.</i>	<i>tons</i>	<i>lb.</i>	
1943	..	267	115	53,839	.2	201
1944	..	232	115	598,542	2.3	2,579
1945	..	232	115	572,853	2.2	2,469
1946	..	232	115	2,384,914	9.2	10,276

During 1946, the above 115 acres also produced 1,236,668 lb. Irish potatoes, 31,576 lb. French beans. Total yield vegetables per acre = 31,766 lb.

Advances to the growers in the form of wages, manure, etc., amounted to Sh. 87,371/15. Total takings from the sale of vegetables amounted to Sh. 187,908/45, leaving a net profit of Sh. 100,537/30, for 115 acres or Sh. 433/35 per grower. Profit per acre Sh. 874/23.

The overall cost per pound of vegetables grown on the co-operative irrigations to the Dried Vegetable Project averaged out at 2.39 cents.

Direct Production—Karatina Sub-Division.—As in 1945, 175.2 acres of irrigation were rented from the landowner and worked by D.V.P. labour—also 85.6 acres of swamp.

Total returns from the 260.8 acres Direct Growing gave:—

<i>Cabbage</i>	<i>Carrot</i>	<i>Potatoes</i>	<i>French beans</i>	<i>Total yield</i>	<i>Total per</i>
				<i>lb.</i>	<i>acre in lb.</i>
1,083,666	2,708,635	2,068,742	255,535	6,116,578	23,453

KARATINA SHORT RAINS, 1945 BONUS

		Cabbage	Carrot	Total Earned	No. of Growers	Growers	Highest Amount	Average
		Lb.	Lb.	Sh. cts.			Sh. cts.	Sh. cts.
Karatina	1 A.	325	580	2,398 27	424	121	131 92	19 85
	2	275	505	1,315 71	272	77	108 57	17 08
	3	953	100	16 68	3	1	16 68	16 68
Gichuthuni	5	1,545	1,845	1,169 27	72	28	93 18	41 76
	6	2,620	—	16,502 32	619	216	357 48	76 83
Gaikuyu	7	380	445	4,877 11	326	185	163 09	26 32
	8	1,010	790	3,516 06	364	115	139 69	30 06
	9	1,320	445	4,499 75	440	134	183 88	33 58
Chehe	10	475	630	2,229 58	332	110	148 87	20 02

KERUGOYA DIVISION LONG RAINS, 1946

		Cabbage	Carrot	Total Earned	No. of Growers	Growers	Highest Amount	Average
		Lb.	Lb.	Sh. cts.			Sh. cts.	Sh. cts.
Kerugoya	..	—	—	—	—	—	—	—
Kagumo	..	—	2,440	2,722 12	320	110	97 13	24 74
Gichugu	..	—	—	—	—	—	—	—

KARATINA DIVISION LONG RAINS, 1946

		Cabbage	Carrot	Total Earned	No. of Growers	Growers	Highest Amount	Average
		Lb.	Lb.	Sh. cts.			Sh. cts.	Sh. cts.
Gichuthuni Sections 5 and 6	..	1,220	—	1,012 64	238	72	86 25	14 06

KARATINA BONUS
KARATINA DIVISION LONG RAIN PLANTING, 1945

	Poundage to Qualify		Total Amount Earned	No. of Registered Growers	No. of Qualified Growers	Highest Amount	Average Amount
	Cabbage	Carrot					
	<i>Sh. cts.</i>						
KARATINA SECTION							
Karatina Section 1	2,721	2,354	8,692 72	990	325	201 59	26 74
2	2,009	1,433	3,167 77	549	179	127 19	17 69
3	3,685	1,841	603 88	91	32	28 11	18 87
4	—	1,795	622 61	102	33	59 00	18 68
Gichutheni 5	1,082	2,248	974 39	147	41	198 48	23 76
6	1,041	—	1,961 33	535	210	29 62	9 34
Gaikuyu 7	2,516	1,200	5,551 47	693	291	210 69	19 07
8	1,566	3,019	6,712 08	362	274	155 58	24 31
9	2,232	2,511	5,874 67	381	232	155 02	25 32
Chehe 10	635	2,960	3,839 21	548	150	110 67	25 29
KERUGOYA DIVISION LONG RAIN PLANTING, 1945							
Kerugoya ..	277	5,049	24,958 02	1,752	582	294 27	42 82
Kagumo ..	627	5,105	25,412 26	1,700	563	363 99	45 13
Gichugu Irrigation ..	5,083	1,898	22,684 81	692	219	785 58	103 53
Gichugu Rains ..	236	3,900	21,534 92	1,829	526	302 30	40 96

Manure.—

(a) Receipts of manure imported into the area:—

					<i>cu. ft</i>
1. Karatina Long Rains	..	..	..	..	501,954
2. Karatina Short Rains	..	..	..	..	402,968
Total					904,922

(b) Distribution:—

<i>Co-operative Irrigations</i>	<i>Direct Production</i>	<i>Growers</i>
	<i>and Nurseries</i>	
<i>cu. ft.</i>	<i>cu. ft.</i>	<i>cu. ft.</i>
303,922	594,457	7,222
Total = 904,922 cu. ft.		

Factory Production**KARATINA FACTORY**

	Receipts	To Kerugoya	Rations	Waste	Processed	Output
	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Tons</i>
Cabbage ..	1,838,476	—	48,366	27,130	1,762,980	26·32
Carrot ..	6,724,493	—	44,497	478,127	6,201,869	180·66
Potatoes ..	12,478,334	157,240	357,427	730,683	11,232,984	607·63
Sweet Potatoes	—	—	—	—	—	—
Beans ..	555,887	—	1,486	2,470	551,931	16·15
Paprika ..	6,396	—	—	—	6,396	·34
TOTAL ..	21,603,586	157,240	451,776	1,238,410	19,756,160	831·10

Note.—1. Supplies on hand, 31st December, 1946—Nil.

2. Issues to Field (seed)—660 lb.

3. Receipts from outside sources and included in the above:—

Potato Control and Gibson and Co.—67,531.96 lb. Other sources—57,251.38 lb. Total = 124,783.34 lb.

Loss in Processing and Drying.—

	<i>Loss</i> <i>per cent</i>	<i>Return</i> <i>per cent</i>
Potatoes	87.90	12.10
Carrot	94.10	5.90
Cabbage	95.90	4.10
Sweet Potatoes (Non-processed).		
Beans	93.30	6.70
Sweet Pepper	88.86	11.14

Mechanical Efficiency.—

	<i>unit hours</i>
The actual capacity for the year	70,080
Maintenance, repairs, alterations and holidays ..	25,190
Net operating hours	<u>44,890</u>

KERUGOYA FACTORY

	Receipts	To Karatina	Rations	Waste	Processed	Output
	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Tons</i>
Carrot ..	3,614,149	—	—	29,110	3,585,039	136·97
Cabbage ..	2,119,713	—	81,461	107,167	1,931,085	55·94
Potatoes ..	623,925	—	—	—	623,925	35·35
	<u>6,357,787</u>	<u>—</u>	<u>81,461</u>	<u>136,277</u>	<u>6,140,049</u>	<u>228·26</u>

	<i>unit hours</i>
Capacity of factory	17,280
Maintenance, repairs, alterations and holidays, lack of trimming facilities (labour)	<u>5,004</u>
Net operating hours	<u>12,276</u>

Remarks.—The Kerugoya factory was closed down at the end of March, 1946.

Loss in Processing and Drying.—

	<i>Loss per cent</i>	<i>Return per cent</i>
Potatoes	86.70	13.30
Carrot	91.40	8.60
Cabbage	93.80	6.20

*Finance.—**Payments to Natives, 1946:—*

	<i>Sh.</i>
(a) For vegetables	750,244/25
„ wages	473,861/58
„ bicycle allowances	564/00
„ manure	1,100/00
„ wood fuel	60,550/25
„ charcoal	1,144/50
„ miscellaneous	<u>5,699/60</u>
Total	<u>Sh. 1,293,164/18</u>

(b) Value of issues to natives:—

Rations	Sh. 194,720/00
-----------------	----------------

Mechanical Efficiency—Machinery.—

Extensive alterations in the lay-out of the processing machinery and low-tension wiring were carried out. At Sagana Falls there were extensive alterations to the high-and-low tension wiring systems between the two Power Houses.

Essential mechanical and electrical safety-guards were installed at the Factory and Hydro-Electric Station.

Fairly trouble-free running was experienced throughout the year.

General

During March, 1946, the Project completed the estimate of 1,200 tons given to the Military in September, 1945, with the exception of 50 tons. On the 1st April, the Karatina Factory started on a contract of 1,000 tons, calling for 750 tons of potatoes and the balance in vegetables. The output of the factory to a great extent depended on outside sources for supplies of fresh products which were not forthcoming owing to the famine in Tanganyika, the decision to send potatoes to the famine relief area in the Machakos District and further to the shortfall in the estimates in the Rift Valley area.

In conjunction with the administrative officers, barazas were held during the year, handing back the land to the native owners as and when the crop in each area had been picked.

The factory closed down on the 8th December, 1946, the staff being given a month's salary in lieu of notice and the factory placed on a care and maintenance basis.

Since the inception of the Project, the production of dehydrated products totalled 14,815,696 lb., value Sh. 24,435,272/50; the total of fresh vegetables grown by registered African growers for the factory totalled 141,196,436 lb. During the period, payments to employees and growers, including rations and clothing, totalled Sh. 7,696,244/57.

F. J. FERGUSON,
Officer in Charge.

Beans	Value	Sweet Potatoes	Value	Bonus	Total Debit	Total Credit	Profit	Loss	Total Vegetable	Labours	Lbs. per Labour	Cost per Acre	Area Acres	Yield per Acre
<i>Lb.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Sh. cts.</i>	<i>Lb.</i>			<i>cents</i>		<i>Lb.</i>
A 1	—	—	—	861 20	2,648 65	5,962 33	3,313 68	—	120 288	8	15,036	2 2	3 5	34,368
3	—	—	—	1,265 57	4,406 60	9,413 63	5,007 03	—	186,061	12	15,505	2 2	5 1	36,482
4	—	—	—	1,808 64	6,562 90	14,412 72	7,849 82	—	297,356	17	17,491	2 2	8 5	34,983
5	—	—	—	1,061 17	4,508 60	9,498 73	3,440 13	—	161,102	13	12,392	2 8	6 3	25,572
6	—	—	—	1,030 18	4,776 20	9,419 43	4,643 23	—	184,615	13	14,201	2 6	6 7	27,554
7	—	—	—	1,488 03	4,998 55	11,719 52	6,720 97	—	228,377	13	17,413	2 2	7 3	31,010
Block A.	—	—	—	7,514 85	27,901 50	58,876 36	30,974 86	—	1,175,799	76	15,471	2 37	37 4	31,438
B 1	—	—	—	999 98	3,563 30	8,409 31	4,846 01	—	158,706	11	14,428	2 2	3 9	40,694
2	—	—	—	1,003 32	4,433 00	9,404 89	4,971 89	—	186,515	12	15,543	2 4	3 9	31,086
3	—	—	—	429 96	1,530 65	3,385 47	1,854 82	—	66,701	5	13,340	2 3	1 8	37,056
4	—	—	—	1,027 21	3,829 65	8,824 42	4,994 77	—	163,443	11	14,868	2 3	5 3	30,838
5	—	—	—	1,167 59	4,157 15	9,333 54	5,176 39	—	184,233	11	16,748	2 2	5 4	34,117
6	—	—	—	851 51	3,536 40	7,934 30	4,397 90	—	145,389	10	14,539	2 4	5 0	29,076
7	—	—	—	1,021 69	4,165 55	9,177 40	5,021 85	—	172,068	11	15,642	2 4	5 6	30,726
8	—	—	—	983 07	4,260 10	9,030 92	4,770 82	—	171,359	12	14,279	2 4	4 8	35,639
9	—	—	—	751 46	3,136 30	7,276 37	4,140 07	—	133,313	10	13,331	2 3	4 0	33,328
Block B.	—	—	—	8,235 82	32,602 10	72,776 65	40,174 55	—	1,381,727	93	14,857	2 36	41 8	33,055 6
C 1	—	—	—	981 71	4,129 90	8,998 40	4,868 50	—	175,379	21	14,615	2 3	4 6	38,126
2	—	—	—	847 29	3,455 40	7,634 91	4,179 51	—	145,478	11	13,295	2 4	4 2	34,637
3	—	—	—	796 60	3,914 95	7,432 07	3,517 12	—	142,717	11	12,974	2 7	5 2	27,445
4	—	—	—	810 37	4,067 28	7,955 83	4,067 28	—	153,971	11	13,971	2 6	5 7	27,012
5	—	—	—	935 27	3,515 00	7,848 18	4,333 18	—	163,137	10	15,314	2 3	5 0	30,627
6	—	—	—	894 67	3,776 50	7,736 77	3,960 27	—	153,789	10	15,379	2 4	5 3	29,016
7	—	—	—	1,003 61	4,187 25	8,649 13	4,461 88	—	171,159	10	17,116	2 4	5 9	29,010
Block C.	—	—	—	6,269 63	26,867 55	56,255 35	29,387 80	—	1,095,630	75	14,608	2 46	35 9	30,518 9
1946	—	—	—	22,020 30	87,371 15	187,908 36	100,537 21	—	3,653,156	244	14,972	2 39	115 1	31,738 9
A. B. & C.	—	—	—	23,703 66	89,804 11	90,962 43	10,069 06	9,010 74	2,850,386	244	11,681	3 1	115 1	24,764
1945	—	—	—	27,039 47	68,376 84	102,154 79	33,777 95	—	3,312,602	232	14,278	2 07	115 1	23,771
1944	2,705 20	942 37	37 68	—	66,975 07	19,658 01	—	47,317 06	918,665 1/2	287	3,440	7 4	115 1	8,199
1943	—	—	—	—	—	—	—	—	—	—	—	—	—	—
3,536	—	—	—	—	—	—	—	—	—	—	—	—	—	—

IRRIGATION. CARROT CROP PLANTED—APRIL, MAY, JUNE, 1946. LONG RAINS

IRRIGATION	Area Acre	YIELD IN LB.					Total Yield Lb.	Yield per acre Lb.	Yield from Interplanted	
		June	July	August	September	October			Beans	Potatoes
									Green Beans Lb.	Ln.
Ihwagi Irrigation, A. . .	37.5	—	694	61,078	180,203	219,836	461,811	12,314	5,742	101,084
Ihwagi Irrigation B. . .	41.8	—	19	62,066	189,042	233,879	485,006	11,603	4,180	110,300
Ihwagi Nursery . . .	4.5	—	—	—	38,619	22,834	61,553	13,678	579	8,001
Karatina Nursery . . .	2.1	—	—	—	31,782	13,721	45,503	21,668	358	2,522
Karindundu Nursery . .	2.1	—	—	—	—	28,723	28,723	13,677	—	3,339
Kirigo . . .	2.8	—	—	—	3,481	25,450	28,931	10,332	5,295	6,219
Karindundu Irrigation .	36.0	—	22,032	66,136	62,816	277,533	428,517	11,903	10,132	76,467
Ndurumoini . . .	5.4	—	—	—	9,021	49,046	74,939	13,877	3,889	5,554
Kururu . . .	23.5	—	27,163	123	80	213,781	241,517	10,277	13,630	87,790
Mukongoro . . .	13.0	—	—	5,284	62,760	—	68,044	5,234	21,340	7,198
Gatundu . . .	37.5	—	5,634	29,275	35,488	327,900	399,062	10,641	89,684	121,058
Turi . . .	36.0	49	20,769	—	17,198	123,849	162,005	4,500	73,557	58,616
Kangocho . . .	2.8	—	—	—	4,677	22,952	27,629	9,867	4,462	4,992
Cacharage . . .	9.9	—	7,117	—	14,556	49,518	94,203	9,414	18,762	11,042
Weru Muhia . . .	4.1	—	—	374	11,463	43,521	55,358	13,502	8,022	6,139
Thakumi Irrigation . .	6.8	—	—	—	13,800	29,225	43,025	6,327	12,699	—
Sagana . . .	22.0	—	13,475	38,399	15,663	36,677	51,874	2,357	802	127,940
Gaikuyu . . .	3.5	—	—	—	32,703	—	52,340	14,954	2,456	5,458
Kariko . . .	3.3	—	—	—	—	—	67,286	20,389	—	6,573
Itoga . . .	3.0	—	—	—	—	30,184	30,184	10,028	—	11,851
	297.6	49	96,903	262,735	723,352	1,783,313	2,907,510	9,769	275,589	762,143

Average yield July to November per acre : Carrot, 9,769 lb. ; Green Beans, 829 lb. ; Potatoes, 2,295 lb.
Average total yield per acre = 12,893 lb.

IRRIGATION. CABBAGE CROP PLANTED—APRIL, MAY, JUNE, 1946. LONG RAINS

IRRIGATION	Area Acre	Yield from Interplanted			Yield from Interplanted	
		Beans	Potatoes	Beans	Potatoes	
Gatundu . . .	34.5	270,472	55,624	118,325	64,653	
Kururu . . .	7.0	—	—	—	7,436	
Turi . . .	2.0	—	—	1,665	31,376	
Ruiruru . . .	5.0	—	6,458	39,230	29,856	
	48.5	270,472	62,082	157,555	96,174	
				38,812	135,063	
				760,168	15,673	
				20,424	20,424	

This area in above yield
for Potatoes and Beans
5 acres interplanted with
potatoes.

IHWAGI AND KARINDUNDU IRRIGATION SYNDICATES ANALYSIS AND EXPENDITURE, 1946

Syndicates	Miscellaneous	Wages	Manure	Cabbage	Value	Carrots	Value	Chillies	Value	Green Beans	Value	Potatoes	Value
A.	Sh. cts.	Sh. cts.	Sh. cts.	Lb.	Sh. cts.	Lb.	Sh. cts.	Lb.	Sh. cts.	Lb.	Sh. cts.	Lb.	Sh. cts.
	13 30	1,375 35	1,260 00	—	—	87,503	2,625 09	—	—	30	1 20	32,755	2,474 84
	8 00	2,598 36	1,800 00	—	—	127,672	3,830 16	—	—	183	7 32	58,206	4,310 58
	73 50	3,429 40	3,060 00	—	—	209,488	6,284 94	—	—	3,266	130 64	84,592	6,188 50
	15 00	2,225 60	2,268 00	—	—	113,674	3,410 22	—	—	661	26 44	46,767	3,450 90
	32 50	2,235 70	2,448 00	—	—	119,375	3,581 25	—	—	1,223	48 92	64,017	4,759 08
	7 50	2,363 05	2,628 00	—	—	151,143	4,534 29	—	—	379	15 16	74,855	5,682 04
Block A...	149 80	14,287 70	13,484 00	—	—	808,865	24,265 95	—	—	5,742	229 68	361,192	26,865 94
B.	—	2,123 30	1,440 00	—	—	99,721	2,891 63	—	—	638	25 52	58,347	4,392 18
	30 00	2,243 00	2,160 00	—	—	122,795	3,683 85	—	—	623	24 92	63,097	4,692 80
	—	2,882 65	648 00	—	—	45,739	1,372 17	—	—	239	9 56	20,723	1,573 78
	—	2,029 65	1,800 00	—	—	99,187	2,975 61	—	—	587	23 48	63,669	4,798 12
	—	2,249 15	1,908 00	—	—	125,833	3,774 99	—	—	586	23 44	57,814	4,367 52
	—	1,735 40	1,800 00	—	—	88,011	2,640 33	—	—	88	3 52	57,280	4,438 94
	—	2,175 55	1,980 00	—	—	105,951	3,178 53	—	—	316	12 64	66,801	4,964 54
	—	2,532 10	1,728 00	—	—	106,377	3,209 31	—	—	869	34 76	63,513	4,803 78
	—	1,696 30	1,440 00	—	—	78,179	2,345 37	—	—	234	9 36	54,900	4,170 18
Block B...	30 00	17,668 10	14,904 00	—	—	872,393	26,171 79	—	—	4,180	167 20	505,154	38,201 84
C.	—	2,077 90	2,052 00	—	—	112,605	3,378 15	—	—	3,485	139 40	59,289	4,499 14
	—	1,763 40	1,692 00	—	—	91,104	2,733 12	—	—	3,020	120 80	51,354	3,933 70
	—	1,826 95	2,088 00	—	—	88,615	2,658 45	—	—	2,602	104 08	51,500	3,872 94
	—	1,728 55	2,160 00	—	—	96,304	2,889 12	—	—	3,329	133 16	54,338	4,123 18
	—	1,607 00	1,908 00	—	—	100,301	3,009 03	—	—	2,192	87 68	50,644	3,816 20
	—	1,760 50	2,016 00	—	—	102,410	3,072 30	—	—	2,374	94 96	49,005	3,674 84
	—	1,955 25	2,232 00	—	—	112,315	3,369 45	—	—	4,652	186 08	54,192	4,089 94
Block C...	—	12,719 55	14,148 00	—	—	703,654	21,109 62	—	—	21,654	866 16	370,322	28,009 94
1946	—	—	—	—	—	—	—	—	—	—	—	—	—
A. B. & C.	179 80	44,975 35	42,516 00	—	—	2,384,912	71,547 36	—	—	31,576	1,263 04	1,236,668	93,077 72
1945	288 76	48,034 43	41,540 92	—	42,286 32	572,853	17,185 59	19,303	1,930 30	143,914	5,756 56	—	—
1944	1,866 20	41,819 41	24,691 23	2,114,316	53,131 56	598,542	17,956 26	38,451	3,845 10	4,560	182 40	13,010	910 70
1943	1,809 72	53,023 00	10,794 55	851,564	17,032 28	53,839	1,595 18	1,198-5	119 85	—	—	—	—

KARATINA DIVISION
SWAMP YIELD, 1946. CARROTS PLANTED APRIL AND MAY
CARROT YIELD IN Lb.

SWAMP	Area	CARROT YIELD IN LB.								Total Yield	Lbs. per Acre	Interplanted with Beans
		June	July	August	September	October	November	December				
Gathanji	11-0	—	25,886	—	—	—	—	—	25,886	2,353	Interplanted with Beans	
Kinyariti	14-1	—	2,212	54,183	—	—	—	—	56,395	3,999		
Thakumi	11-5	—	44,324	—	—	—	—	—	44,324	3,854		
Nyanyagga	3-0	—	—	30,169	—	—	—	—	30,169	10,056		
SWAMP POTATOES YIELDS—FEBRUARY TO AUGUST, 1946 PLANTINGS												
Itoga	22-0	—	—	36,220	—	—	27,408	16,162	79,790	3,629	Interplanted with Carrots	
Kinyariti	14-1	—	—	—	—	11,504	22,453	—	33,957	2,408		
Gathanji	11-0	—	—	—	—	22,264	—	—	22,264	2,024		
Nyanyagga	27-0	360	114,332	65,660	—	—	51,462	30,921	262,735	9,731		
	74-1	360	114,332	101,880	—	—	33,768	101,323	398,746	5,381		
SWAMP GREEN BEANS YIELDS PLANTED APRIL AND MAY, 1946												
Kinyariti	14-1	16,821	43,432	—	—	—	—	—	60,253	4,273	Interplanted with Cabbage	
Gathanji	11-0	33,042	5,150	—	—	—	—	—	38,192	3,472		
Thakumi	11-5	43,324	—	—	—	—	—	—	43,324	3,767		
Nyanyagga	27-0	12,208	16,222	1,282	—	—	—	—	29,712	1,100		
	63-6	105,395	64,804	1,282	—	—	—	—	171,481	2,696		
SWAMP CABBAGE YIELDS PLANTED DECEMBER, 1945, AND JANUARY AND FEBRUARY, 1946												
		April	May	June	July							
Itoga	22-0	32,722	151,941	43,860	59,930	—	—	—	288,453	13,111	Interplanted with potatoes	
Nyanyagga	27-0	47,749	238,959	55,382	—	—	—	—	342,090	12,570		
	49-0	80,471	390,900	99,242	59,930	—	—	—	630,543	12,868		
SWAMP CABBAGE YIELDS PLANTED MAY, 1946												
				August	September		November	December				
Itoga	3-0	—	—	5,077	4,676	—	15,181	10,121	35,055	11,685		

